

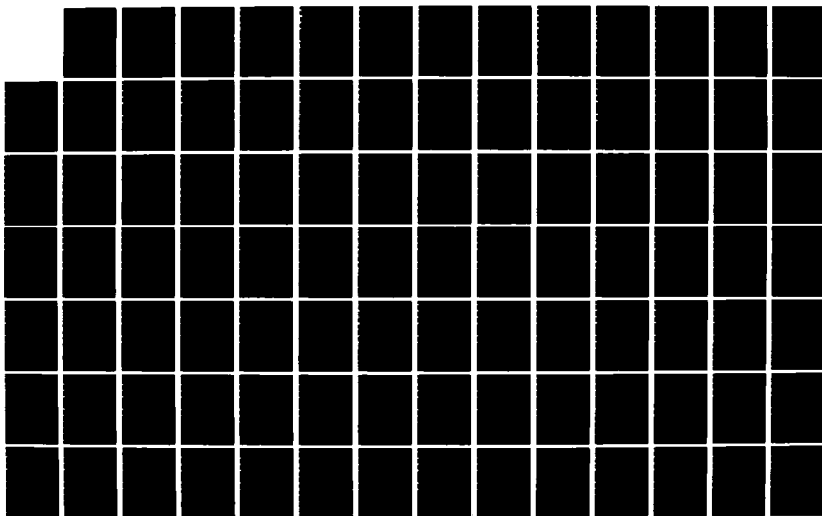
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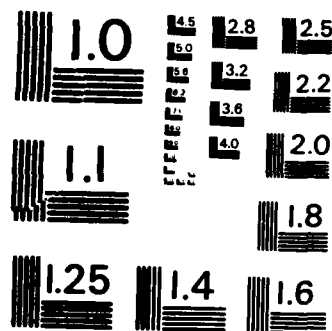
LGM-30B STAGE II DISSECTED MOTOR TEST REPORT(U) OGDEN  
AIR LOGISTICS CENTER HILL AFB UT PROPELLANT ANALYSIS  
LAB E M DALABA JAN 86 MAQCP-514(86)

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HEADQUARTERS  
OGDEN AIR LOGISTICS CENTER  
UNITED STATES AIR FORCE  
HILL AIR FORCE BASE, UTAH 84056

LGM-30B  
STAGE II  
DISSECTED  
MOTOR  
TEST REPORT

PROPELLANT ANALYSIS LABORATORY

MAQCP REPORT NR 514(86)

January 1986

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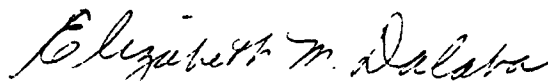
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LGM-30B, STAGE II

DISSECTED MOTOR

TEST REPORT

Author



ELIZABETH DALABA, Chemist  
Component & Combustion Test Unit

Statistical Review By



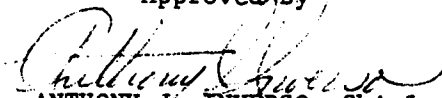
REONA CHRISTENSEN, Math/Stat.  
Data Analysis Unit

Engineering Review By



BRYAN L. BELL, Project Engineer  
Service Engineering

Approved By



ANTHONY J. INVERSO, Chief  
Propellant Analysis Laboratory

January 1986

Prod Qlty & Reliability Division  
Directorate of Maintenance  
Ogden Air Logistics Center  
United States Air Force  
Hill Air Force Base, Utah 84056



# ABSTRACT

20-4-11  
Data analysis in this report represents three test periods on dissected motor S/N 0022687. Two of the tests were performed prior to a change in the specimen conditioning requirements.

A Scheffe' test was used to determine where significant differences in test data occurred. Regressions of individual motor trends for many parameters are included in this report. There are statistically significant trend lines when compared to a slope of zero except for stress relaxation modulus. The three points used represent two populations since a change in humidity conditioning occurred in 1985 testing. Therefore, regressions are for visual reference only.

Multi-motor plots are included to show the relationship of motor S/N 0022687 to the other RSLP motors. The data for all Stage II dissected

motors tested at OO-ALC are shown on these plots. Keywords: Dissected Motor Solid Propellant.

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LGM-30B Stage II Dissected Motors Test Report 471(82)	Jul 1982
LGM-30B Stage II Dissected Motors Test Report 496(84)	Feb 1984

# GLOSSARY OF ABBREVIATIONS AND TERMS

Aging Trend	(Refer to Figure 3 or statistical analysis) A change in properties or performance resulting from aging of material or component
ANX	Outer propellant, ANP-2862
ANY	Inner Propellant, ANP-2864
ASPC	Aerojet Strategic Propulsion Company
Bi-Propellant	Equal sections of ANP-2862 and ANP-2864 in one specimen
CSA	Cross Sectional Area
DB	Dogbone
Degradation	Gradual deterioration of properties or performance
E	Modulus (psi), defined as the slope of the line drawn tangent to the initial linear portion of the curve
EB	End bonded
EGL	Effective Gage Length
$e_m$	Strain at Maximum Stress (in/in)
$e_r$	Strain at Rupture (in/in)
"F" ratio	The ratio of the variance accounted for by the regression function to the random unexplained variance. The regression function having the most significant "F" ratio is used for plotting data. The ratio is also used in detecting significant changes in random variation between succeeding time points.
JANNAF	Joint Army, Navy, NASA, Air Force Committee
MAQCP	Propellant Laboratory at OO-ALC
OO-ALC	Ogden Air Logistics Center
Regression	The general form of the regression equation is $Y = a + bX$
Regression Line	Line representing mean test values with respect to time
$S_b$	Standard error of estimate of the regression coefficient
$S_e$ or $S_{y.x}$	Standard deviation of the data about the regression line
$S_m$	Maximum Stress (psi)

## GLOSSARY OF TERMS AND ABBREVIATIONS (cont)

$S_r$	Stress at Rupture (psi)
Standard Deviation ( $S_y$ )	Square root of variance
Strain Rate	Crosshead speed divided by the EGL
't' Test	A statistical test used to detect significant differences between a measured parameter and an expected value of the parameter (determines if regression slope differs from zero at the 95% confidence level).
Variance	The sum of squares of deviations of the test results from the mean of the series after division by one less than the total number of test results
3 Sigma Band	The area between the upper and lower 3 sigma limit. It can be expected that 99.73% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed
90-90 Band	It can be stated with 90% confidence that 90% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed



## INTRODUCTION

PURPOSE: The purpose of this program is to continue surveillance testing of Minuteman Reentry System Launch Program Stage II propellant. This surveillance will elucidate the aging characteristics of the propellant and, using statistical trends derived from laboratory testing, will help to establish the service life expectancy of similar motors in the inventory.

BACKGROUND: Surveillance testing was initiated in 1963 on cartons of propellant cast from the same propellant used in motor manufacture.

In 1971, all laboratory prepared insulation material and case-to-propellant bond specimens were destroyed in a conditioning chamber malfunction. The number of cartons of propellant were also near depletion, which would have terminated the OO-ALC Surveillance Program.

A force modernization program made available some older Minuteman I Stage II motors. In 1973, three of these motors were selected to represent the motor inventory and were dissected for laboratory surveillance testing. The motors selected were S/N 0022135, cast date June 1963; S/N 0022583, cast date January 1964; and S/N 0022788, cast in July 1964. An additional motor, S/N 0022687, cast in April 1964, became available and was dissected in 1981 for continuing surveillance testing. The test data from Stage II dissected motors were assumed to have a normal population that could be combined. This was a fallacious assumption as shown in MANPA Report Nr. 496(84) where individual regressions for each motor were made with S/N 0022687 visually displayed on the multi plots.

Motor S/N 0022687 was dissected in a different manner from other motors. The distance between cuts B and C, and cuts C and D was increased to 16 inches (figures 1 and 2).

Segments D, E and F from section 4 of motor S/N 0022687 were used for testing. Figure 3 illustrates the cutting plan for the latest test period. The general test directive (GTD-2 Dissect Amendment 2, April 1984) specified that test specimens be conditioned at controlled relative humidity. Other changes were different test temperatures for stress relaxation, deletion of some testing, and addition of mini-thin tensile from the bore area.

Motors which have been dissected to date are:

<u>Motor S/N</u>	<u>Cast Date</u>
0022135	63162
0022583	64008
0022788	64197
0022687	64096

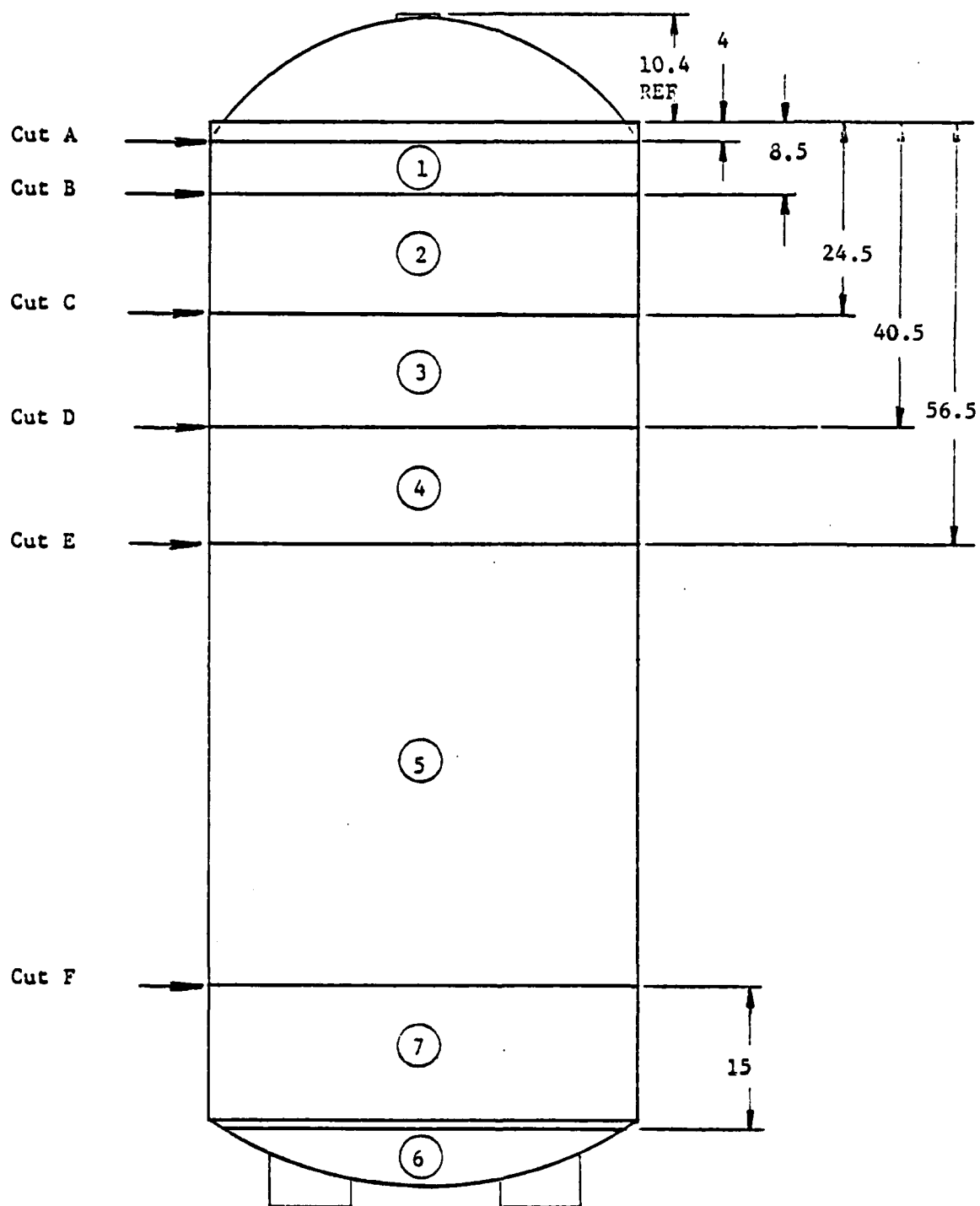


Figure 1 Dissection layout of Cuts,  
Locations and Section Numbers



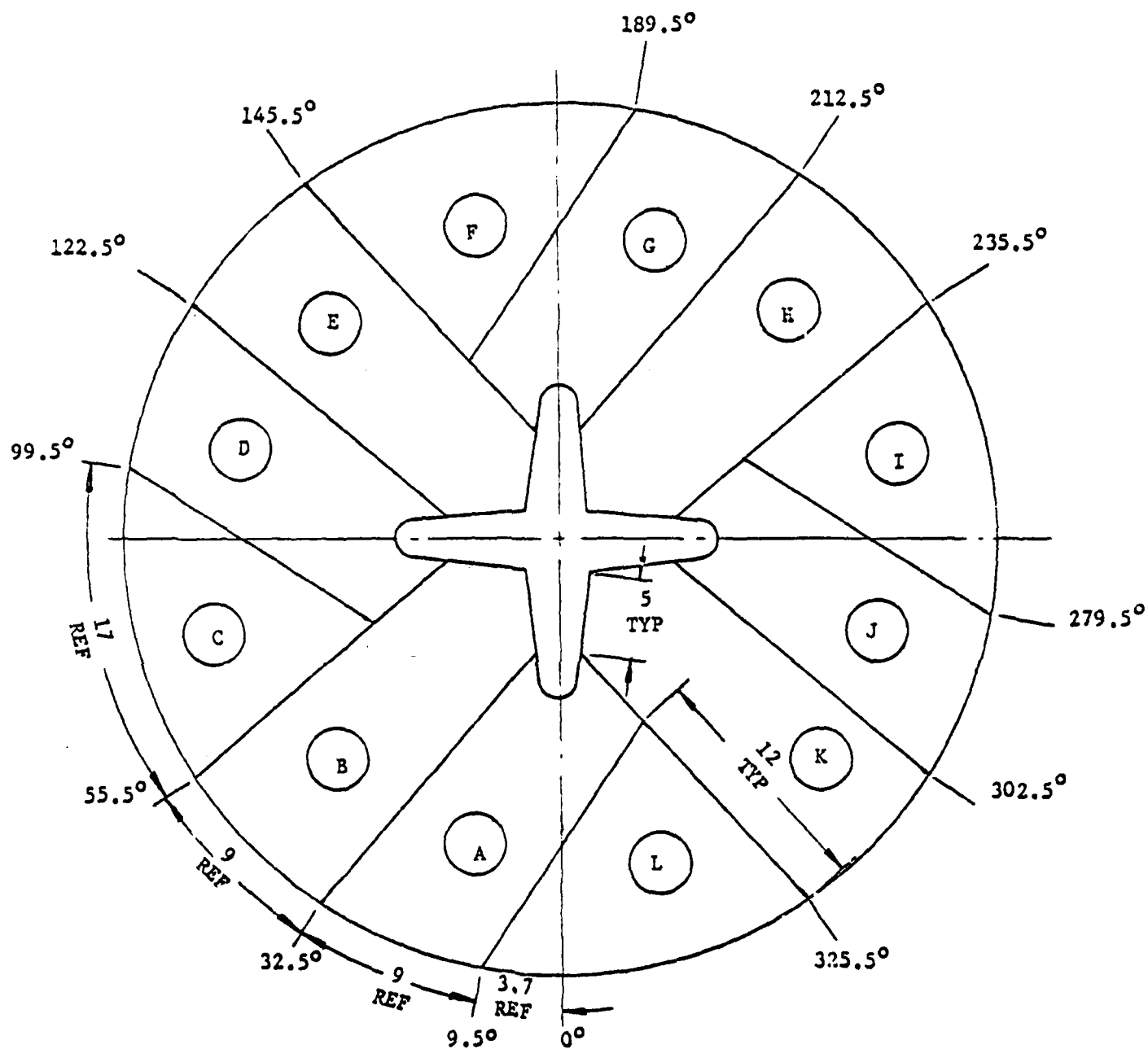


Figure 2 Section 3 and 4 Segment Layout and Letter Identification



## STATISTICAL ANALYSIS

Statistical analyses have been performed to determine what statistically significant aging trends are occurring in the propellant. Test data for this report have been derived from the physical/chemical testing of a Stage II dissected motor, S/N 0022687.

For this test period, analyses were made to determine: (1) what aging trends are demonstrated for motor S/N 0022687 within three test periods (1982, 1983 and 1985) and (2) the visual relationship between the data from motor S/N 0022687 and data from previously dissected motors S/Ns 0022135, 0022583 and 0022788. Statistically, no direct motor-to-motor comparisons can be made using the combined motor regressions.

At the present time, there are three data points for motor S/N 0022687 two of which were tested prior to a change in specimen conditioning. With this change another variable is introduced. Furthermore, a statistical bias is introduced when only three data points are used. Therefore, the individual regression plots are for visual observation only. At least two more test periods under the current test conditions will be required before there is any stability in the data base. A summary for the regression trend lines can be found in Table 2.

The linear regression program was used to show aging trends. The linear equation  $Y = a + bX$  was found to be the best fit model for the data in this report. The unique mathematical regression equation is listed on the top of each regression plot.

The multi-symbol combined plot program uses a unique plotting code for each motor's data point on the regression plots. This type of reporting is not reliable at this time since the motors cannot be statistically combined as discussed in MANPA Report Nr. 496(84), February 1984. However, this method of data plotting allows a visual display of the mean data from each motor and the overall relationships between dissected motors.

The data from motor S/N 0022687 were statistically compared for combinability using Analysis of Variance at the 5% significance level (Table 1). By comparing the mean values and variances within these values, it was determined which data groups have a non-significant difference and which are combinable.

The Scheffe' test determines where the significant differences lie between data groups in the incompatibility of the "F" test results, using Analysis of Variance. The significance of these data groups may be attributed, in part, to aging and random variations in testing. These variations are being investigated. The Scheffe' test was used only if the calculated "F" value was significant. The Scheffe' test is fairly consistent for the outer high rate hydrostatic tensile test, the inner stress relaxation test and for the TCLE inner and outer tests.

The Shore A hardness information consisting of conditioned and unconditioned data was statistically compared for combinability by comparing data variations ("F" test) and mean values ('t' test). Hardness comparisons (Table 4) resulted in significant differences resulting from variance and mean testing. The inner, Shore A, 10 second hardness has a non-significant difference and these data are combinable. Table 6 contains individual hardness values.

For a comparison of minithin values between four blocks, the mean values were checked for combinability. Table 4 contains the Analysis of Variance results for inner and outer propellant. Individual minithin values are found in Table 3.

## DEFINITION OF THE MASTER STRESS RELAXATION CURVE

The master stress relaxation curve is a composite curve representing the behavior of a polymer over a wide range of time and temperature relationships. From a curve constructed at a given strain level, any combination of time and temperature can be used to determine a corresponding stress relaxation modulus.

### DETERMINATION OF STRESS RELAXATION MODULUS USING A MASTER STRESS RELAXATION CURVE

From test data at a particular strain level, a polymer's stress relaxation modulus corresponding to any combination of time and temperature can be determined. The horizontal axis of the master stress relaxation plot is a logarithmic value  $(t/a_T)$ , and the vertical axis is a linear value,  $E(t)298/T$ , where  $E(t)$  is the stress relaxation modulus dependent on time.  $T$  is temperature in degrees Kelvin,  $a_T$  equals any relaxation time at temperature  $T$  divided by the corresponding time at the reference temperature (298 degrees Kelvin or 77°F), and ' $t$ ' is relaxation time in seconds. The stress relaxation modulus for any combination of temperature and time can be determined by using the following steps:

a. For each stress relaxation plot there is associated a plot of temperature in degrees F versus  $\log a_T$ . From this plot, determine  $\log a_T$  corresponding to the temperature at which stress relaxation modulus is desired.

b. Determine  $\log 't'$  or  $\log$  of the desired stress relaxation time.

c. Determine  $\log (t/a_T)$  by using the equation:

$$\log (t/a_T) = \log t - \log a_T.$$

d. Place the determined value of  $\log (t/a_T)$  in the horizontal axis of the large plot and reference the master stress relaxation curve to determine the corresponding value  $E(t)298/T$  in the vertical axis.

e. Determine  $298/T$  and divide into  $E(t)298T$  to find  $E(t)$ , the stress relaxation modulus at the desired time and temperature.

## TEST RESULTS

### INTRODUCTION:

Testing in 1985 represents the third test period for motor S/N 0022687. This is the first time testing with specimens conditioned at controlled RH. Consequently, the 1985 data represent a different population than earlier testing.

A different statistical approach was used in which the means were analyzed for the 1982, 1983 and 1985 test data. This type of analysis will demonstrate any change between the data from the three test periods. Table 1, Analysis of Variance, shows the significance or non-significance of means. From the table it can be seen that only a few year-to-year comparisons are not significant in means. Stress relaxation modulus of outer propellant is an exception.

A summary of the regression trend lines is shown in Table 2.

A sample size summary follows the regression plot to which it applies.

Multi-motor regression plots using other dissected motor data, were made to show the relationship of data from motor S/N 0022687 to the other motors.

Table 3 shows the 1985 mini-thin tensile data and Table 4 is an analysis of variance for this data. Table 5 lists the stress relaxation data for all three years and shows the change in test temperatures based on the revised GTD. Hardness data for 1985, showing changes in data caused by conditioning, are shown in Table 6, with "F" and 't' test significance given in Table 7. Bond properties are shown in Table 8 and the miscellaneous data in Table 9.

### A. UNIAXIAL TENSILE TEST:

OUTER: Very low rate tensile at 0.0002 in/min shows a significant decrease in the regression trend line for maximum stress and modulus

(figures 4 and 6) with a corresponding increase in strain at rupture (figure 5). The regression trend lines for low rate tensile at 2.0 in/min however, shows a significant increase in strain at rupture (figure 8) with non-significant changes in the other parameters (figures 7 and 9).

INNER: Very low rate tensile shows a significant increase in the trend line for maximum stress (figure 10). The other parameters do not show a significant trend (figures 11 and 12). At 2.0 in/min, both maximum stress and modulus show a significant increase in the regression trend line (figures 13 and 15). Strain at rupture does not show a trend (figure 14).

BI-PROPELLANT: Very low rate tensile shows a significant increase in regression trend lines for all parameters (figures 16, 17 and 18).

B. BIAXIAL TENSILE TEST: Biaxial rails tested at 0.2 in/min show a significant increase in the slope for strain at rupture (figures 20 and 23), and a significant decreasing trend line in modulus for outer propellant (figure 21). Inner propellant does not show a significant change in modulus (figure 24). Neither propellant shows a significant change in maximum stress (figures 19 and 22).

C. HIGH RATE HYDROSTATIC TENSILE: Shortened dogbones are tested at 1750 in/min with 500 psi pressure. Under these conditions, the outer propellant shows a significant increase in the slope for maximum stress and strain at rupture (figures 25 and 26) with a significant decrease in the trend line for modulus (figure 27).

Inner propellant, on the other hand, shows a significant decrease in the slope for maximum stress and modulus (figures 28 and 30) while strain at rupture does not show a significant change (figure 29).

D. MINITHIN TENSILE: Minithin tensile specimens are cut from the case and bore areas as shown in figure 3. A change in the General Test Directive stipulated certain slices to be tested, i.e., 0.1, 0.2, 0.3, 0.6, and 1.0 inch intervals. This was done for the inner propellant and two blocks of outer propellant. In some instances, no valid data for these particular specimens was obtained. When additional blocks from the outer propellant were cut (blocks 4EU5 and 4EU6), a decision was made to test all slices so that if one point was missed the adjacent specimen would provide useable data. No regressions were made since only current data are shown on the plots. The influence of the liner is evident by the variability in the first few slices adjacent to the liner (figures 31 thru 35). Bore propellant data also show variability as shown in figures 36 through 40. Data are listed in Table 3 and analysis of variance is provided in Table 4.

E. STRESS RELAXATION: The latest General Test Directive mandated a change in the temperatures at which the specimens were tested. Prior testing at  $-65^{\circ}\text{F}$  and  $-40^{\circ}\text{F}$  resulted in so many bond failures that representative data could not be obtained. Less severe temperatures of  $0^{\circ}\text{F}$  and  $40^{\circ}\text{F}$  were substituted. Data are shown in Table 5. The master curves for 1985 testing are shown in figures 41 and 42. These curves appear to be quite similar to those published in MANPA Report Nr. 496(84). There are no significant changes in relaxation modulus for either outer or inner propellants (figures 43 thru 50).

F. THERMAL COEFFICIENT OF LINEAR EXPANSION (TCLE):

Both outer and inner propellant show a significant increasing trend line slope for the coefficient of linear expansion above the glass transition temperature (figures 52 and 55). Neither propellant shows a significant



change in glass transition temperature (figures 53 and 56) or in expansion below the glass transition temperature (figures 51 and 54).

G. HARDNESS: Tensile specimens were tested for hardness when the specimens were first machined. They were then conditioned at  $35 \pm 5\%$  RH for 14 days and hardness readings were taken for a second time. These data are shown in Table 6. Statistically, there is a significant difference between the conditioned and unconditioned test data except for inner propellant at 10 second hardness readings (Table 7).

Regressions were made using unconditioned data. The outer propellant shows a significant decrease in the trend line slope at 10 seconds (figure 57). There is no significant change in the inner propellant (figure 58).

#### H. BOND PROPERTIES:

SHEAR: Shear strength tested at 2.0 in/min, 500 psi does not show a change from 1983 testing (Table 8). These specimens had the Avcoat removed from the metal case before testing. Tensile specimens were tested at 20 in/min and 500 psi. There is a marked difference in the two sets of data, and the difference shown at 20 in/min between 1983 and 1985 is striking. There was failure in the propellant at less than 2mm deep in five of the six specimens with a crystalline appearance on the failed surface. This apparent crystallinity may be the result of a higher concentration of  $\text{NH}_4\text{ClO}_4$  since this surface appearance was not noticable in previous years.

CONSTANT LOAD TENSILE: The specimens showed liner to propellant failure at high loads. As loads decreased, failure within the propellant increased. There was a crystalline appearance to the failed surface. See Table 8.

I. MISCELLANEOUS PROPERTIES: Swell ratio, gel fraction and moisture were done on specimens of insulation and liner. These specimens were obtained from the barrel section. Data are provided in Table 9, and represent means of two replicates.

## CONCLUSIONS AND RECOMMENDATIONS

Tighter control of humidity has had an effect on the data, and may account for the shift in means (see hardness study). This change in pre-conditioning does not affect all tests or all parameters to the same degree.

There are significant increases in strain at rupture in the outer propellant. If both maximum stress and modulus showed decreases of similar magnitude, the probability of the increase being real is greater. There is no such consistency evident at this time. Moreover, a decrease in strain is of greater concern than an increase because the loss of strain capability leads to potential motor failure.

Stress relaxation testing at 77°F does not show significant changes. Shore A hardness (10 sec) readings would tend to suggest that elasticity of the propellant is decreasing.

Inner propellant does not show the same magnitude of changes as is suggested by the data for outer propellant.

Statistically, the distribution of variance is significant in most tests. However, since three test periods are the minimum required for regression, and one represents a change here, only further testing will determine if the trend lines remain significant. At least two more test periods with the same conditions are needed to provide a stable data base.

The relationship of motor S/N 0022687 to previously dissected motors is ambiguous. Testing did not begin until the motor was nearly 18 years old whereas other motors were approximately half that age when initially tested. Therefore, no comparisons can be made at similar ages.

## RECOMMENDATIONS:

Testing of this motor should be continued in order to determine if

changes in means and variance are real or if they are random.

Greater emphasis should be placed on maintaining the same test conditions. Elimination of some tests is understandable, but wherever possible the program should remain essentially the same as it presently exists.

Although the regressions show two data points from unconditioned specimens and one from conditioned, the same general trend is observed and the regression trend line may be correct. Therefore, it is strongly recommended that this motor be tested as soon as possible to verify this trend.

TABLE 1. ANALYSIS OF VARIANCE

Test	1982 Mean	Nr Samp	Std Dev	1983 Mean	Nr Samp	Std Dev	1985 Mean	Nr Samp	Std Dev	Cal F Value	Sig of F	1982 vs 1983	1982 vs 1985	1983 vs 1985
Tensile, Very Low Rate, 0.0002 in/min														
Outer, Max Stress	45.7	6	2.75	47.6	6	3.51	40.2	6	1.26	12.26	S	N/S	S	S
Strain at Max Stress	.194	6	.0037	.224	6	.0177	.251	6	.0148	27.23	S	S	S	S
Strain at Rupture	.235	6	.0123	.258	6	.0208	.292	6	.0179	16.53	S	N/S	S	S
Stress at Rupture	42.3	6	2.92	43.5	6	3.77	37.8	6	1.51	6.56	S	N/S	N/S	S
Modulus	338.5	6	18.15	290.3	6	40.20	235.2	6	18.54	21.02	S	S	S	S
Inner, Max Stress														
Strain at Max Stress	48.6	10	2.18	47.9	6	1.65	54.0	6	.731	22.68	S	N/S	S	S
Strain at Rupture	.356	10	.0250	.272	6	.0629	.372	6	.0030	13.74	S	S	N/S	S
Stress at Rupture	40.7	10	.0146	.329	6	.0930	.435	6	.0195	7.52	S	S	N/S	S
Modulus	46.1	10	2.91	44.1	6	.99	50.2	6	1.18	12.90	S	N/S	S	S
	185.5	10	5.21	243.7	6	54.27	210.3	6	4.72	8.02	S	S	N/S	N/S
Tensile, Low Rate, 2.0 in/min														
Outer, Max Stress	129.9	6	12.81	112.1	6	7.71	122.8	5	7.51	5.02	S	S	N/S	N/S
Strain at Max Stress	.388	6	.0420	.376	6	0.135	.502	5	.0179	32.79	S	N/S	S	S
Strain at Rupture	.592	6	.0198	.627	6	.0520	.753	5	.0819	12.56	S	N/S	S	S
Stress at Rupture	108.8	6	15.51	92.0	6	9.61	108.0	5	8.87	3.71	N/S	---	---	---
Modulus	944.5	6	89.76	737.5	6	159.32	855.4	5	69.75	4.85	S	S	N/S	N/S
Inner, Max Stress														
Strain at Max Stress	123.1	9	4.80	116.5	6	6.30	137.4	6	2.97	29.15	S	S	S	S
Strain at Rupture	.549	9	.1087	.423	6	.0777	.577	6	.0196	5.96	S	S	N/S	S
Stress at Rupture	.730	9	.0401	.712	6	.1042	.751	6	.0390	.0554	N/S	---	---	---
Modulus	111.4	9	8.22	96.7	6	10.03	126.5	6	2.32	22.42	S	S	S	S
	643.9	9	62.14	750.7	6	134.93	848.2	6	35.47	10.73	S	N/S	S	N/S
Tensile, Biaxial Low Rate, 0.2 in/min														
Outer, Max Stress	104.3	6	3.57	110.0	6	3.09	106.2	6	2.02	5.78	S	S	N/S	N/S
Strain at Max Stress	.316	6	.0111	.354	6	.0102	.438	6	.0110	200.9	S	S	S	S
Strain at Rupture	.416	6	.0251	.542	6	.0262	.558	6	.0233	52.69	S	N/S	S	S
Stress at Rupture	95.5	6	5.01	99.9	6	4.30	98.4	6	2.88	1.72	N/S	---	---	---
Modulus	696.0	6	41.69	761.5	6	25.68	452.5	6	16.69	178.31	S	S	S	S
Inner, Max Stress														
Strain at Max Stress	118.1	6	9.00	114.2	6	1.10	116.1	6	13.84	0.246	N/S	---	---	---
Strain at Rupture	.447	6	.0313	.460	6	.0174	.485	6	.0591	1.45	N/S	---	---	---
Stress at Rupture	.529	6	.0402	.566	6	.0372	.595	6	.0400	4.37	S	N/S	S	N/S
Modulus	113.3	6	8.93	108.8	6	1.92	108.0	6	13.36	0.559	N/S	---	---	---
	477.5	6	8.31	470.2	6	15.69	518.5	6	63.51	2.81	N/S	---	---	---

TABLE 1. ANALYSIS OF VARIANCE (cont)

Test	1982 Mean	Nr Samp	Std Dev	1983 Mean	Nr Samp	Std Dev	1985 Mean	Nr Samp	Std Dev	F Value	Sig of F	1982 vs 1983	1982 vs 1985	1983 vs 1985
Tensile, HR Hydro, 1750 in/min, 500 psi														
Outer, Max Stress	557.4	6	8.77	560.6	6	4.25	575.9	6	11.86	17.47	S	N/S	S	S
Strain at Max Stress	.333	6	.0101	.340	6	.0110	.544	6	.0693	51.45	S	N/S	S	S
Strain at Rupture	.419	6	.0147	.432	6	.0202	.657	6	.0737	53.32	S	N/S	S	S
Stress at Rupture	541.6	6	9.25	592.7	6	6.85	550.8	6	15.70	1.20	N/S	---	---	---
Modulus	6887.3	6	958.83	5650.5	6	482.02	4141.8	6	78.00	29.39	S	S	S	S
Inner, Max Stress	606.1	6	4.57	591.2	6	10.46	589.1	6	3.09	10.98	S	S	S	N/S
Strain at Max Stress	.507	6	.0322	.572	6	.0255	.529	6	.0118	10.84	S	S	N/S	S
Strain at Rupture	.665	6	.0518	.748	6	.0541	.679	6	.0256	5.65	S	S	N/S	N/S
Stress at Rupture	583.8	6	7.20	559.2	6	18.63	562.2	6	7.88	7.05	S	S	S	N/S
Modulus	5445.5	6	596.93	4037.8	6	739.64	4035.3	6	184.32	12.71	S	S	S	N/S
Tensile, Very Low Rate, 0.0002 in/min, Bi-Propellant														
Max Stress	37.2	6	2.21	39.9	8	2.18	47.5	6	.314	51.03	S	N/S	S	S
Strain at Max Stress	.217	6	.0135	.229	8	.0106	.262	6	.0092	27.16	S	N/S	S	S
Strain at Rupture	.238	6	.0089	.260	8	.0064	.285	6	.0067	63.24	S	S	S	S
Stress at Rupture	35.4	6	2.29	36.9	8	2.30	45.9	6	.454	53.26	S	N/S	S	S
Modulus	232.2	6	6.79	228.8	8	10.08	241.7	6	4.76	4.76	S	N/S	N/S	S
Stress Relaxation, 3% Strain														
Outer, 20°F, 10 Sec	1635.7	3	32.33	1959.0	3	44.84	2002.7	6	226.76	4.84	S	N/S	S	N/S
50 Sec	958.0	3	41.51	1058.3	3	3.79	1074.8	6	102.49	2.28	N/S	---	---	---
100 Sec	793.3	3	36.91	866.7	3	12.74	875.8	6	85.24	1.64	N/S	---	---	---
1000 Sec	444.3	3	47.10	418.0	3	33.64	492.2	6	40.54	3.68	N/S	---	---	---
77°F, 10 Sec	505.7	3	37.75	466.7	3	73.64	530.7	6	60.59	1.15	N/S	---	---	---
50 Sec	352.0	3	41.51	340.3	3	55.90	369.2	6	47.67	0.38	N/S	---	---	---
100 Sec	318.0	3	38.51	300.7	3	49.64	328.5	6	42.12	0.42	N/S	---	---	---
1000 Sec	242.0	3	30.05	228.7	3	35.50	243.5	6	32.48	0.22	N/S	---	---	---
120°F, 10 Sec	399.0	3	13.86	312.7	3	35.57	306.2	6	42.78	6.93	S	N/S	N/S	S
50 Sec	322.3	3	10.79	246.0	3	28.62	242.0	6	34.93	7.94	S	S	S	N/S
100 Sec	300.0	3	8.89	233.1	3	28.93	221.3	6	30.20	9.04	S	S	S	N/S
1000 Sec	244.7	3	4.04	167.7	3	32.52	183.2	6	21.92	10.36	S	S	S	N/S

TABLE 1. ANALYSIS OF VARIANCE

TABLE I. ANALYSIS OF VARIANCE														
Test	1982 Mean	Nr Samp	Std Dev	1983 Mean	Nr Samp	Std Dev	1985 Mean	Nr Samp	Std Dev	F Value	Sig of F	1982 V <sub>B</sub> 1983	1982 V <sub>B</sub> 1985	1983 V <sub>B</sub> 1985
Stress Relaxation, 3% Strain														
Outer, 160°F, 10 Sec	274.7	3	26.58	336.7	3	10.69	251.3	6	36.65	7.88	S	N/S	N/S	S
50 Sec	229.0	3	21.52	269.6	3	15.37	203.2	6	29.59	6.90	S	N/S	N/S	S
100 Sec	214.3	3	22.03	248.3	3	13.32	185.3	6	25.94	7.75	S	N/S	N/S	S
1000 Sec	164.7	3	19.66	184.3	3	9.86	139.0	6	16.58	8.37	S	S	N/S	N/S
Inner, 20°F, 10 Sec														
50 Sec	1469.7	3	119.30	1567.3	3	29.70	1671.5	6	44.96	9.43	S	N/S	S	N/S
100 Sec	791.0	3	20.30	817.0	3	23.52	964.7	6	28.27	59.57	S	N/S	S	S
1000 Sec	622.3	3	30.60	661.3	3	35.72	798.5	6	31.52	36.39	S	N/S	S	S
77°F, 10 Sec														
50 Sec	342.0	2	21.20	272.7	3	51.05	466.8	6	17.34	45.38	S	N/S	N/S	S
100 Sec	529.0	3	63.50	402.0	3	8.72	479.5	6	19.21	11.08	S	S	N/S	S
1000 Sec	380.0	3	52.72	288.7	3	5.51	331.8	6	12.77	8.76	S	S	N/S	N/S
120°F, 10 Sec														
50 Sec	340.3	3	50.30	251.0	3	4.58	296.7	6	11.84	9.28	S	S	N/S	N/S
1000 Sec	253.3	3	38.60	185.3	3	3.06	219.3	6	9.83	8.96	S	S	N/S	N/S
160°F, 10 Sec														
50 Sec	399.0	3	13.86	302.3	3	15.18	338.0	6	13.73	36.46	S	S	S	S
100 Sec	296.7	3	43.50	231.3	3	10.50	264.2	6	9.58	6.46	S	S	N/S	N/S
1000 Sec	279.0	3	43.03	220.1	3	11.59	246.2	6	9.54	5.32	S	S	N/S	N/S
160°F, 10 Sec														
50 Sec	220.0	3	24.27	174.3	3	11.72	192.8	6	5.98	8.79	S	S	N/S	N/S
100 Sec	294.3	3	33.84	267.7	3	4.16	277.0	6	7.48	1.92	N/S	---	---	---
1000 Sec	253.3	3	31.50	214.3	3	5.03	227.7	6	5.32	4.95	S	S	N/S	N/S
Hardness, Shore A, 10 Sec, Outer														
Inner	237.7	3	30.09	200.6	3	4.04	209.2	6	6.01	5.25	S	S	N/S	N/S
Shore A, 10 Sec, Outer														
Inner	189.7	3	20.82	162.3	3	7.51	165.8	6	3.31	6.23	S	S	S	N/S
Shore A, 10 Sec, Outer														
Inner	70.0	8	6.78	63.3	12	2.71	62.5	12	1.31	10.54	S	S	S	N/S
Shore A, 10 Sec, Outer														
Inner	61.6	9	.53	65.2	12	1.34	61.1	12	2.61	18.00	S	S	N/S	S
TCL, Below Tg, Outer														
Tg, Outer	.0000629	3	.00001779	.0000572	4	.000005767	.0001125	7	.00000628	158.07	S	N/S	S	S
Above Tg, Outer	-56	3	2.1	-60	4	1.7	-56	7	2.3	5.11	S	N/S	N/S	S
Below Tg, Inner	.000102	3	.00000319	.0001	4	.00000296	.0000614	7	.00000341	257.78	S	N/S	S	S
Above Tg, Inner	.0000645	3	.000000427	.0000592	3	.00000266	.00001081	6	.00000361	251.06	S	N/S	S	S
Below Tg, Inner	-57	3	1.5	-57	3	2.3	-58	6	1.4	0.54	N/S	---	---	---
Above Tg, Inner	.0000983	3	.00000029	.0000989	3	.00000733	.0000625	6	.00000492	71.73	S	N/S	S	S

S = Significant difference in means. The means are not the same  
NS = Non-significant difference in means. The means are equal  
-- = Non applicable

**NOTE:** All testing was performed at the 5% significance level

TABLE 2  
REGRESSION TREND LINE SUMMARY

<u>Test</u>	<u>Sm</u>	<u>er</u>	<u>E</u>	
Uniaxial Tensile, 0.0002 in/min				
Outer	S(-)	S(+)	S(-)	
Inner	S(+)	NS	NS	
Bipropellant	S(+)	S(+)	S(+)	
Uniaxial Tensile, 2.0 in/min				
Outer	NS	S(+)	NS	
Inner	S(+)	NS	S(+)	
Biaxial Tensile, 0.2 in/min				
Outer	NS	S(+)	S(-)	
Inner	NS	S(+)	NS	
High Rate Hydrostatic Tensile. 1750 in/min				
Outer	S(+)	S(+)	S(-)	
Inner	S(-)	NS	S(-)	
Stress Relaxation, 3% Strain, 77°F	<u>10 sec</u>	<u>50 sec</u>	<u>100 sec</u>	<u>1000 sec</u>
Outer	NS	NS	NS	NS
Inner	NS	NS	NS	NS
Thermal Coefficient of Linear Expansion	<u>Below Tg</u>	<u>Above Tg</u>	<u>Tg</u>	
Outer	NS	S(+)	NS	
Inner	NS	S(+)	NS	
Hardness, 10 sec, Unconditioned				
Outer	S(-)			
Inner	NS			

NS = Non-significant Difference

S(+) = Significant difference in trend line slope in the positive direction

S(-) = Significant difference in trend line slope in the negative direction

TABLE 3

MINITHIN TENSILE DATA  
 Test Temp 77°F, CHS = 1.0 in/min  
 Motor S/N 0022687, 1985 data only  
Outer Propellant

<u>Specimen Location</u>	<u>Max Stress</u>	<u>Strain at Max Stress</u>	<u>Strain at Rupture</u>	<u>Stress at Rupture</u>	<u>Modulus</u>
4EU11	116.4	0.729	0.802	110.2	636
12	120.8	0.731	0.772	116.9	615
13	127.0	0.782	0.876	120.6	586
A	<u>124.2</u>	<u>0.707</u>			<u>557</u>
Block 1 $\bar{X}$	122.1	0.7373	0.8167	115.9	598.5
S.D.	4.568	0.03175	0.05353	5.27162	34.4335
N = 4		4	3	3	4
4EU21	119.8	0.712	0.775	115.3	603
22	124.9	0.764	0.806	122.2	587
23	126.6	0.733	0.786	122.4	580
26	<u>122.4</u>	<u>0.755</u>	<u>0.849</u>	<u>116.7</u>	<u>507</u>
Block 2 $\bar{X}$	123.43	0.7410	0.8040	119.15	369.25
S.D.	2.9691	0.02331	0.0326	3.683	42.6019
N = 4		4	4	4	4
4EU51	98.1	0.628	0.724	92.3	759
52	106.5	0.567	0.726	95.8	822
53	97.2	0.522	0.665	88.7	567
54	101.4	0.492	0.642	90.7	695
55	102.4	0.494	0.661	89.0	631
56	102.7	0.485	0.645	93.0	704
57	102.2	0.486	0.614	94.0	677
58	102.8	0.490	0.683	89.4	677
59	100.9	0.479	0.684	85.2	693
A	104.3	0.495	0.648	93.8	674
B	<u>103.9</u>	<u>0.491</u>	<u>0.643</u>	<u>92.5</u>	<u>708</u>
Block 5 $\bar{X}$	102.04	0.5117	0.66682	91.31	691.55
S.D.	2.65114	0.04584	0.03489	3.0389	64.74313
N = 11		11	11	11	11
4EU61	61.6	0.601	0.731	55.5	558
62	73.8	0.532	0.649	66.3	540
63	81.0	0.511	0.606	74.9	572
64	89.7	0.477	0.626	79.7	663
65	91.2	0.444	0.589	80.1	741
66	91.0	0.444	0.595	81.3	716
67	93.3	0.431	0.560	82.9	738
68	95.2	0.439	0.592	83.0	733
69	96.3	0.441	0.612	83.6	733
A	97.2	0.429	0.617	80.5	756
B	<u>96.7</u>	<u>0.435</u>	<u>0.598</u>	<u>82.6</u>	<u>697</u>
Block 6 $\bar{X}$	87.91	0.4713	0.6159	77.31	677.0
S.D.	11.30836	0.05504	0.44426	8.79471	81.48742
N = 11		11	11	11	11



TABLE 3 (cont)

Inner Propellant

<u>Specimen Location</u>	<u>Max Stress</u>	<u>Strain at Max Stress</u>	<u>Strain at Rupture</u>	<u>Stress at Rupture</u>	<u>Modulus</u>
4EU11	54.2	0.553	0.646	50.5	527
12	55.4	0.603	0.697	52.2	391
13	73.7	0.574	0.739	66.5	579
A	<u>88.8</u>	<u>0.416</u>	<u>0.590</u>	<u>76.9</u>	<u>678</u>
Block 1 $\bar{X}$	68.025	0.5365	0.6680	61.5250	543.75
S.D.	16.4755	0.08291	0.06442	12.51196	119.553
N =	4	4	4	4	4
4EU21	68.8	0.618	0.793	61.1	567
22	73.7	0.604	0.823	64.3	512
23	81.1	0.532	0.670	74.5	591
26	87.2	0.440	0.651	74.4	665
A	<u>89.3</u>	<u>0.437</u>	<u>0.598</u>	<u>79.9</u>	<u>632</u>
Block 2 $\bar{X}$	80.02	0.5262	0.7070	70.840	593.4
S.D.	8.72737	0.08646	0.09649	7.83888	59.0449
N =	5	5	5	5	5
4EU32	89.6	0.439	0.601	78.0	618
33	90.1	0.442	0.609	79.2	592
36	88.1	0.444	0.607	77.1	651
A	<u>86.3</u>	<u>0.429</u>	<u>0.506</u>	<u>79.6</u>	<u>670</u>
Block 3 $\bar{X}$	88.5250	0.4350	0.58075	78.4750	632.75
S.D.	1.70953	0.006658	0.4995	1.14127	34.6350
N =	4	4	4	4	4
4EU42	84.1	0.465	0.526	79.9	512
43	85.2	0.467	0.665	73.2	612
46	85.7	0.456	0.560	78.7	622
A	<u>79.8</u>	<u>0.357</u>	<u>0.392</u>	<u>76.1</u>	<u>576</u>
Block 4 $\bar{X}$	83.7	0.4362	0.53575	76.975	580.5
S.D.	2.68452	0.05305	0.112624	2.97475	49.75607

TABLE 4

ANALYSIS OF VARIANCE FOR MINITHIN DATA  
at The 5% Significance Level

Test Parameter	Location	OUTER PROPELLANT			Cal F Value	Sig of F-Test
		Nr Samples Per Group	Mean	Std Dev		
Max Stress	4EU1	4	122.10	4.5680	33.9429	S
	4EU2	4	123.43	2.9691		
	4EU5	11	102.04	2.6511		
	4EU6	11	87.91	11.3084		
Strain at Max Stress	4EU1	4	0.7373	0.03175	57.1172	S
	4EU2	4	0.7410	0.02331		
	4EU5	11	0.5117	0.04584		
	4EU6	11	0.4713	0.05504		
Strain at Rupture	4EU1	3	0.8167	0.05353	0.6875	NS
	4EU2	4	0.8040	0.03260		
	4EU5	11	0.6668	0.3489		
	4EU6	11	0.6159	0.44426		
Stress at Rupture	4EU1	3	115.90	5.27162	60.9510	S
	4EU2	4	119.15	3.68300		
	4EU5	11	91.31	3.03890		
	4EU6	11	77.31	8.79471		
Modulus	4EU1	4	598.50	34.4335	4.5810	S
	4EU2	4	569.25	42.6019		
	4EU5	11	691.55	64.7431		
	4EU6	11	677.00	81.4874		
INNER PROPELLANT						
Max Stress	4EU1	4	68.025	16.4755	3.4647	S
	4EU2	5	80.020	8.7274		
	4EU3	4	88.525	1.7095		
	4EU4	4	83.700	2.6845		
Strain at Max Stress	4EU1	4	0.5365	0.08291	2.7287	NS
	4EU2	5	0.5262	0.08646		
	4EU3	4	0.4385	0.00666		
	4EU4	4	0.4362	0.05305		
Strain at Rupture	4EU1	4	0.6680	0.6442	0.4175	NS
	4EU2	5	0.7070	0.09649		
	4EU3	4	0.5808	0.49950		
	4EU4	4	0.53575	0.11262		
Stress at Rupture	4EU1	4	61.525	12.51196	4.1371	S
	4EU2	5	70.840	7.83888		
	4EU3	4	78.475	1.14127		
	4EU4	4	76.975	2.97475		

TABLE 4 (cont)

<u>Test Parameter</u>	<u>Location</u>	<u>Nr Samples Per Group</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Cal F Value</u>	<u>Sig of F-Test</u>
Modulus	4EU1	4	543.75	119.5530	1.0355	NS
	4EU2	5	593.40	59.0449		
	4EU3	4	632.75	34.6350		
	4EU4	4	580.50	49.7561		

## NOTE:

S = A significant difference between the 4 means.

NS = No significant difference between the 4 means.

TABLE 5

STRESS RELAXATION DATA  
3% STRAIN, MEAN VALUES

Temp (°F)	Year Tested	<u>OUTER</u>			
		10 sec (psi)	50 sec (psi)	100 sec (psi)	1000 sec (psi)
0	1985	3638	2015	1623	834
20	1982	1635	958	793	444
	1983	1959	1058	866	---
	1985	2003	1075	876	492
40	1985	992	600	506	304
77	1982	506	352	318	242
	1983	467	340	301	229
	1985	531	369	328	244
120	1982	399	322	300	245
	1983	313	246	233	168
	1985	306	242	221	183
160	1982	275	229	214	165
	1983	337	269	248	184
	1985	251	203	185	139
<u>INNER</u>					
0	1985	3383	1881	1531	857
20	1982	1470	791	622	342
	1983	1567	817	661	273
	1985	1672	965	798	467
40	1985	955	576	474	314
77	1982	529	380	340	253
	1983	402	289	261	185
	1985	480	332	297	219
120	1982	399	297	279	220
	1983	302	231	220	174
	1985	338	264	246	193
160	1982	294	253	238	190
	1983	268	214	201	162
	1985	277	228	209	166

TABLE 6

HARDNESS DATA, SHORE A  
Motor S/N 0022687, 1985 Data

Specimen Location	Unconditioned		Conditioned	
	<u>Initial</u>	<u>10 sec</u>	<u>Initial</u>	<u>10 sec</u>
Outer	71	63	70	59
	74	65	70	60
	71	63	71	60
	71	60	71	60
	71	62	63	52
	72	62	67	58
	73	62	70	60
	72	63	71	62
	73	62	72	62
	71	61	71	60
	72	64	72	61
	<u>73</u>	<u>63</u>	<u>71</u>	<u>62</u>
	$\bar{X} =$	72.0	69.92	59.67
	S.D. =	1.044	2.539	2.708
		62.50		
		1.314		
Inner	65	58	66	60
	66	57	72	63
	71	60	71	62
	71	59	71	60
	72	60	70	60
	74	61	71	62
	74	65	71	62
	72	64	70	56
	64	60	66	57
	75	65	68	64
	73	62	71	62
	<u>72</u>	<u>62</u>	<u>68</u>	<u>60</u>
	$\bar{X} =$	70.75	69.58	60.67
	S.D. =	3.696	2.065	2.348
		61.08		
		2.610		

TABLE 7

HARDNESS DATA COMPARISON  
F and t Tests

Test	Unconditioned			Conditioned			Comparison Results
	<u>X</u>	<u>N</u>	<u>S.D.</u>	<u>X</u>	<u>N</u>	<u>S.D.</u>	
Hardness							
Outer Initial	72.0	12	1.044	69.92	12	2.539	S/F
10 sec	62.50	12	1.314	59.67	12	2.708	S/F
Inner Initial	70.75	12	3.696	69.58	12	2.065	S/F
10 sec	61.08	12	2.610	60.67	12	2.348	NS

NS = "F" and 't' results are not significant at the 5% significance level.

S/F = "F" test results are significant.

S/t = "F" test results are not significant, but the 't' test results are significant.

## NOTE:

The F-test compares the variance within data groups.

The t-test compares the means between data groups.

The t-test is not applicable when the F-test shows a significant difference.

TABLE 8  
BOND PROPERTIES

<u>Test Conditions</u>	<u>1982 <math>\bar{X}</math></u>	<u>1983 <math>\bar{X}</math></u>	<u>Without Avcoat 1985 <math>\bar{X}</math></u>
Shear Strength, Composite (psi) 2.0 in/min, 500 psi	171	153.2	152.7
Tensile Strength, Composite (psi) 508 20 in/min, 500 psi		419.5	249.7
Constant Load Tensile (Log Stress (psi) vs Log Time to Failure/min) @ 100 min 37.8		@ 1 min 79.73 @ 10 min 51.23 @ 100 min 32.9	@ 1 min 82.69 @ 10 min 56.74 @ 100 min 38.93 @ 1000 min 26.72

TABLE 9

## MISCELLANEOUS PROPERTIES

<u>Test</u>	<u>1982 <math>\bar{X}</math></u>	<u>1983 <math>\bar{X}</math></u>	<u>1985 <math>\bar{X}</math></u>
Swell Ratio			
Insulation	1.47	1.58	1.15
Liner	2.42	2.07	2.09
Gel Fraction			
Insulation	89.69	87.59	91.16
Liner	63.33	67.52	67.93
Moisture (%)			
Insulation	0.92	1.57	1.37





\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

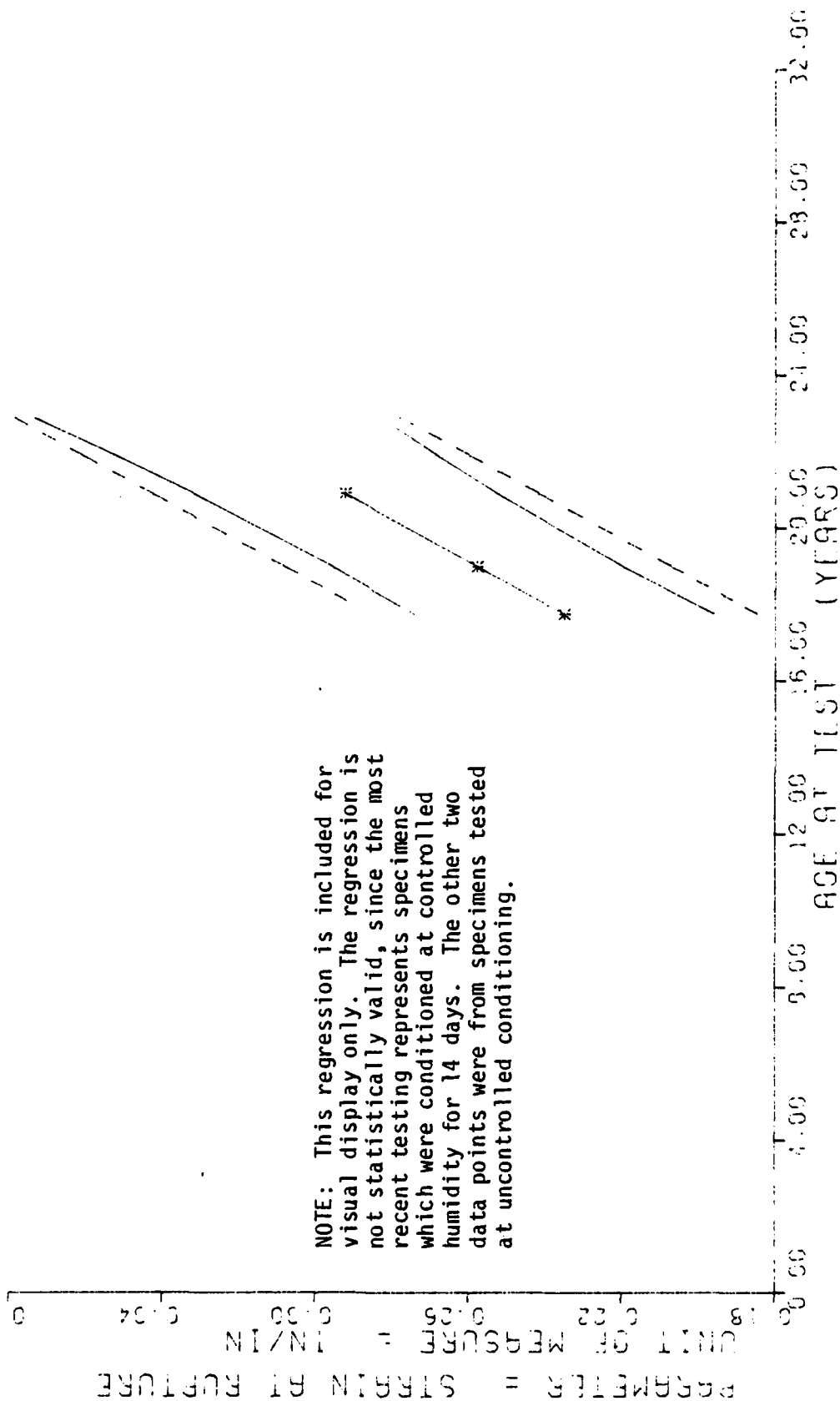
ACL (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+4.5686645E+01	+2.7491374E+00	+4.9759594E+01	+4.2579986E+01	+4.7301895E+01
223.0	6	+4.7581619E+01	+3.4817952E+00	+5.2649593E+01	+4.3839996E+01	+4.4913009E+01
251.0	6	+4.0196655E+01	+1.2489158E+00	+4.1949596E+01	+3.8369995E+01	+4.1250076E+01

II STAGE DSCT MTRS. OUTER, AXIAL POS. V. L. RATE CHS=0.0002 MAX STRESS <0022687>

Figure 4a



Y = 11 - 8.5423321E-02 J + 1.5047998E-03 J \* X)  
 F = +3.54256813E-01 SIGNIFICANCE OF F = SIGNIFICANT S<sub>1</sub> = +2 9180659E-02  
 R = +8.2025438E-01 SIGNIFICANCE OF R = SIGNIFICANT S<sub>2</sub> = +2 5353740E-04  
 T = +5.0352131E+00 SIGNIFICANCE OF T = SIGNIFICANT S<sub>3</sub> = +1.6810122E-02  
 N = 18 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AVG TEMP/RH TEST CONDITIONS = AVG TEMP/RH



11 S1601 0501 MTR <09222687> 500TER.AXIAL FOS.V.I.RATE (HS-0 0002 STRAIN RUPTURE

Figure 5

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+2.3495977E-01	+1.2347518E-02	+2.5799999E-01	+2.2399997E-01	+2.3509848E-01
228.0	6	+2.5787300E-01	+2.0763929E-02	+2.8599999E-01	+2.3199999E-01	+2.5767052E-01
251.0	6	+2.9221642E-01	+1.7915299E-02	+3.1399999E-01	+2.5999999E-01	+2.9220091E-01

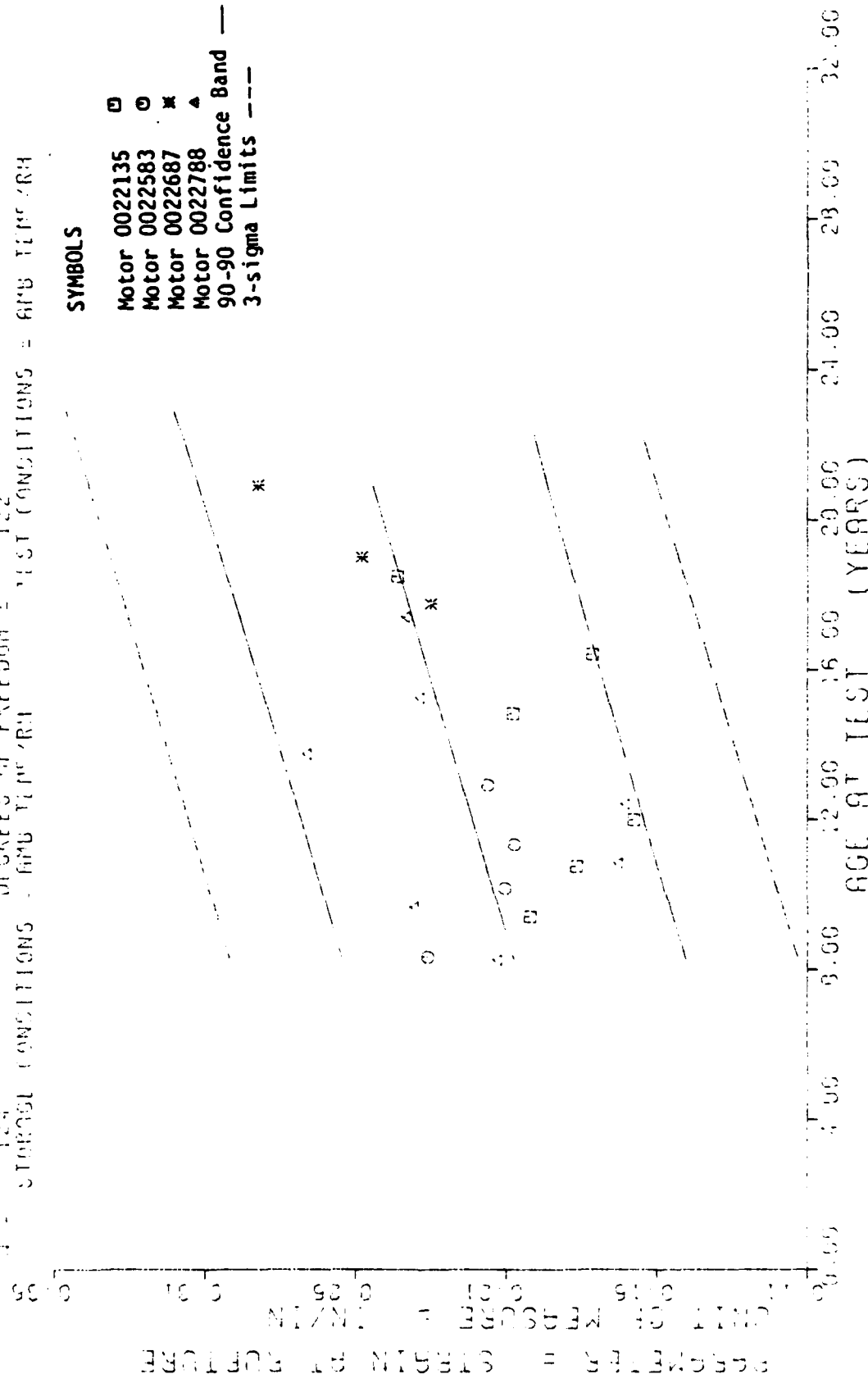
II STAGE DSCT MTR <0022687>, OUTER, AXIAL POS, V.L. RATE CHS=0.0002, STRAIN RUPTURE.

Figure 5-A

Y = 10.1 7691573E-01 ) 1 1 13 0803986E-04 ) \* X )  
 F = 12 6063251E-01  
 R = 14 0544802E-01  
 U = 15 1026151E-06  
 D = 124  
 STORAGE CONDITIONS = 600 TEMPERATURE  
 TEST CONDITIONS = 600 TEMPERATURE

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band —  
 3-sigma Limits ---

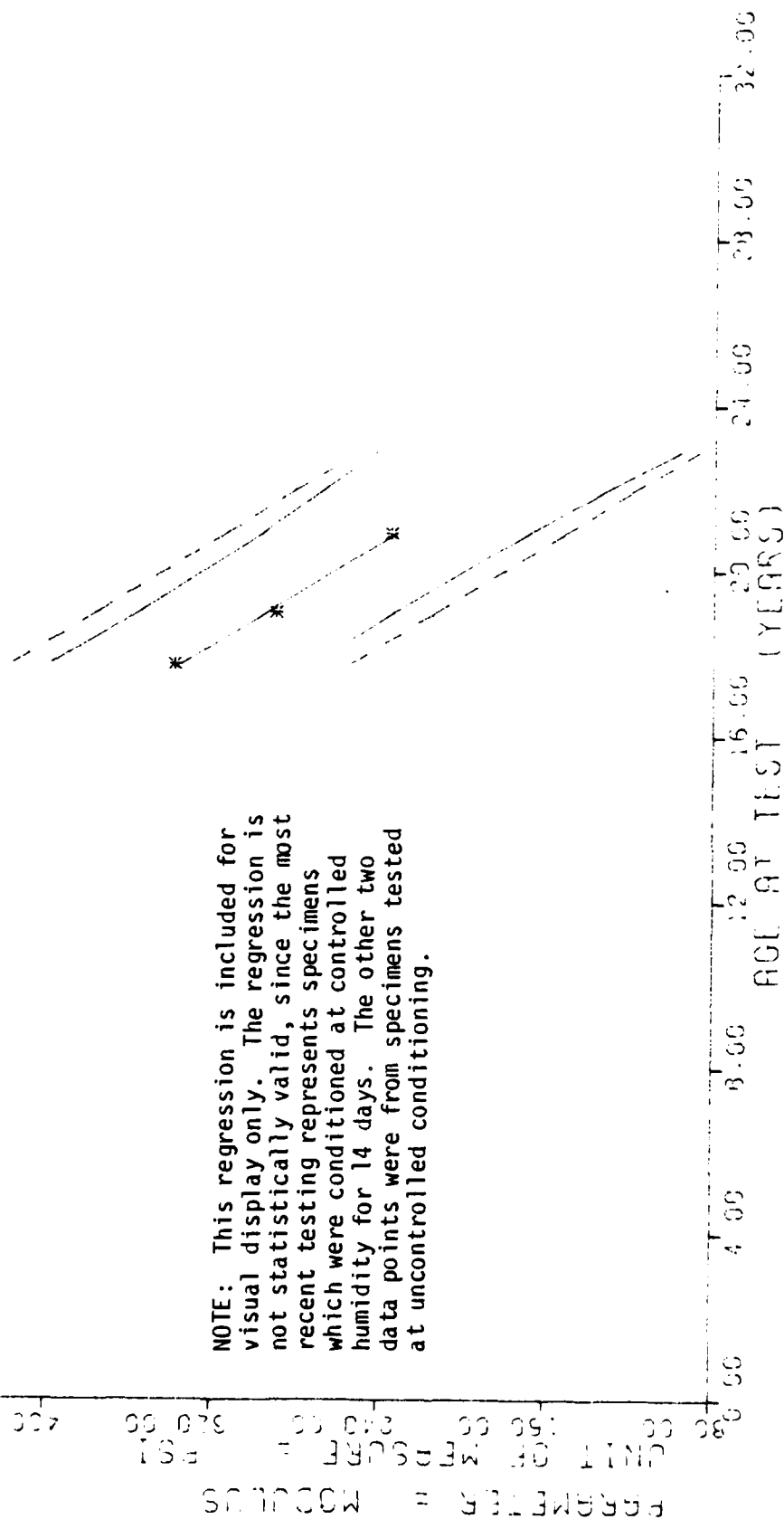


11 STAGE 0501 8105.001E-01 0.0181 005.74 RATE CHS.0 0052 IN/MIN. STRAIN/RUPTURE

Figure 5-B

	Y = 1140 9966245E-02	1 = -2 6018410E-06	1 * X)
F = 12 3546675E-01	SIGNIFICANCE OF F =	SIGNIFICANT	57
BR = 3 5547393E-01	SIGNIFICANCE OF R =	SIGNIFICANT	57
1 = 45 6990755E-00	SIGNIFICANCE OF 1 =	SIGNIFICANT	57
	DEGREES OF FREEDOM = 16		
1 = 5108661 CONDITIONS - 640 TEMP/HR		TEST CONDITIONS - 640	

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represented specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.



**Figure 6**

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+3.3850000E+02	+1.8152134E+01	+3.6500000E+02	+3.1300000E+02	+3.3550024E+02
228.0	6	+2.9016650E+02	+4.0201575E+01	+3.4700000E+02	+2.3700000E+02	+2.9512255E+02
251.0	6	+2.3516665E+02	+1.8540945E+01	+2.6700000E+02	+2.1900000E+02	+2.3321034E+02

II STAGE CSCT MTR <0022687>, CUTER, AXIAL POS, V.L. RATE CHS=0.0002, MCDULUS.

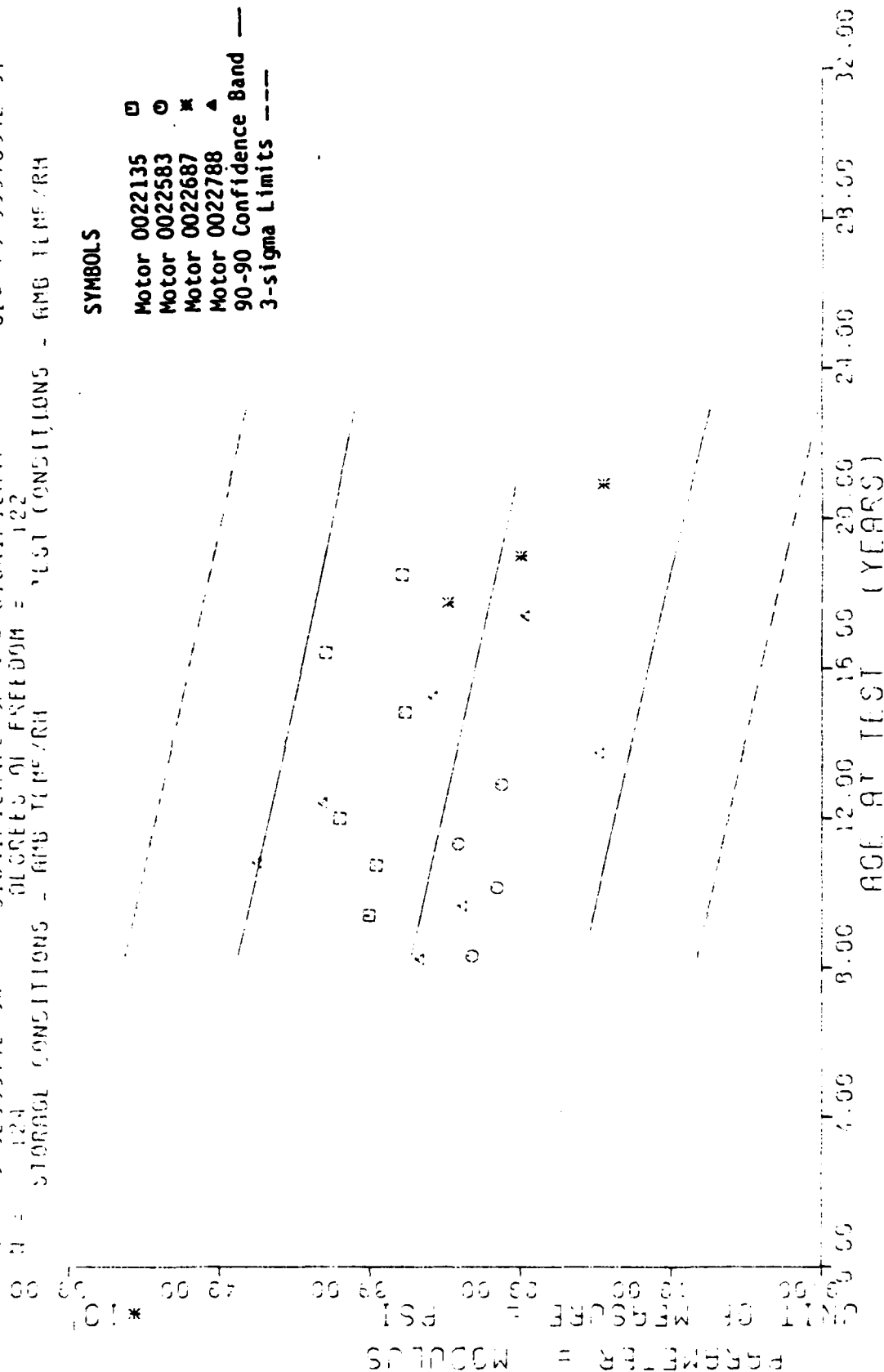
Figure 6-A



F = +1 4618064E-01  
 R = +3 2710778E-01  
 T = +3 9233577E-06  
 H = 124  
 STORAGE CONDITIONS - 6MB TEMPER/RH  
 Y = 11 +4 0836733E+02 ) + 1 -4.5741028E-01 ) \* X )  
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF R = SIGNIFICANT  
 SIGNIFICANCE OF T = SIGNIFICANT  
 DEGREES OF FREEDOM = 122  
 TEST CONDITIONS - 6MB TEMPER/RH

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 ✕  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



11 STAGE TEST MRS. OUTR. AXIAL POS. V. L. RATE CHS-0.9992 IN/MIN. MODULUS

Figure 6-B

$Y = ((+1.5972500E+02) + (-1.6703518E-01) * X)$   
 F = +8.8308851E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  $G_r = +1.1744544E+01$   
 R = -2.2870526E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_g = +1.7774845E-01$   
 L = +9.3972789E-01 SIGNIFICANCE OF L = NOT SIGNIFICANT  $S_t = +1.1785138E+01$   
 N = 18 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

PARAMETER = MAXIMUM STRESS

UNIT OF MEASURE = PSI

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

AGE AT TEST (YEARS)

II STAGE DSC1 MIRS ONLY, OUTER, AXIAL POS. LOW RATE CHS=2.0 MAX STRESS <0022687>

Figure 7

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS NO. GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+1.2092324E+02	+1.2813510E+01	+1.40337598E+02	+1.0767999E+02	+1.2414649E+02
223.0	6	+1.1505663E+02	+7.7169372E+00	+1.2400000E+02	+1.0412998E+02	+1.2164097E+02
251.0	6	+1.2156600E+02	+7.3711455E+00	+1.3J86599E+02	+1.1471998E+02	+1.1779916E+02

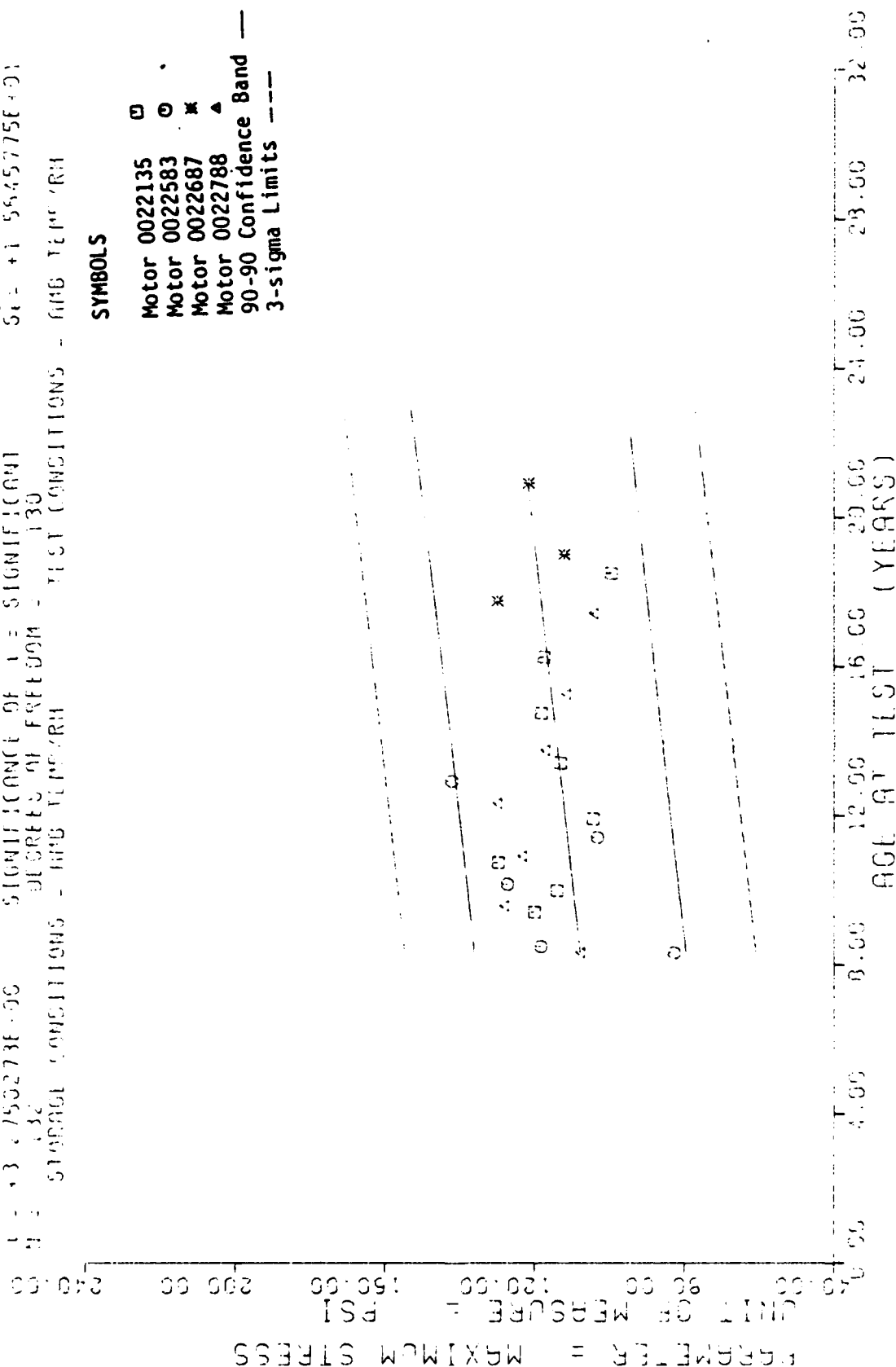
II STAGE BSCT MIRS ONLY. OUTER AXIAL PCS. LOW RATE CHS=2.0 MAX STRESS <0022637>

Figure 7-A

F = +1 0225503E-01 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +2 7602552E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +3 2750273E-00 SIGNIFICANCE OF T = SIGNIFICANT  
 D.F. 132 DEGREES OF FREEDOM = 130  
 STORAGE CONDITIONS - HMB TEMPERH TEST CONDITIONS - HMB TEMPERH

# SYMBOLS

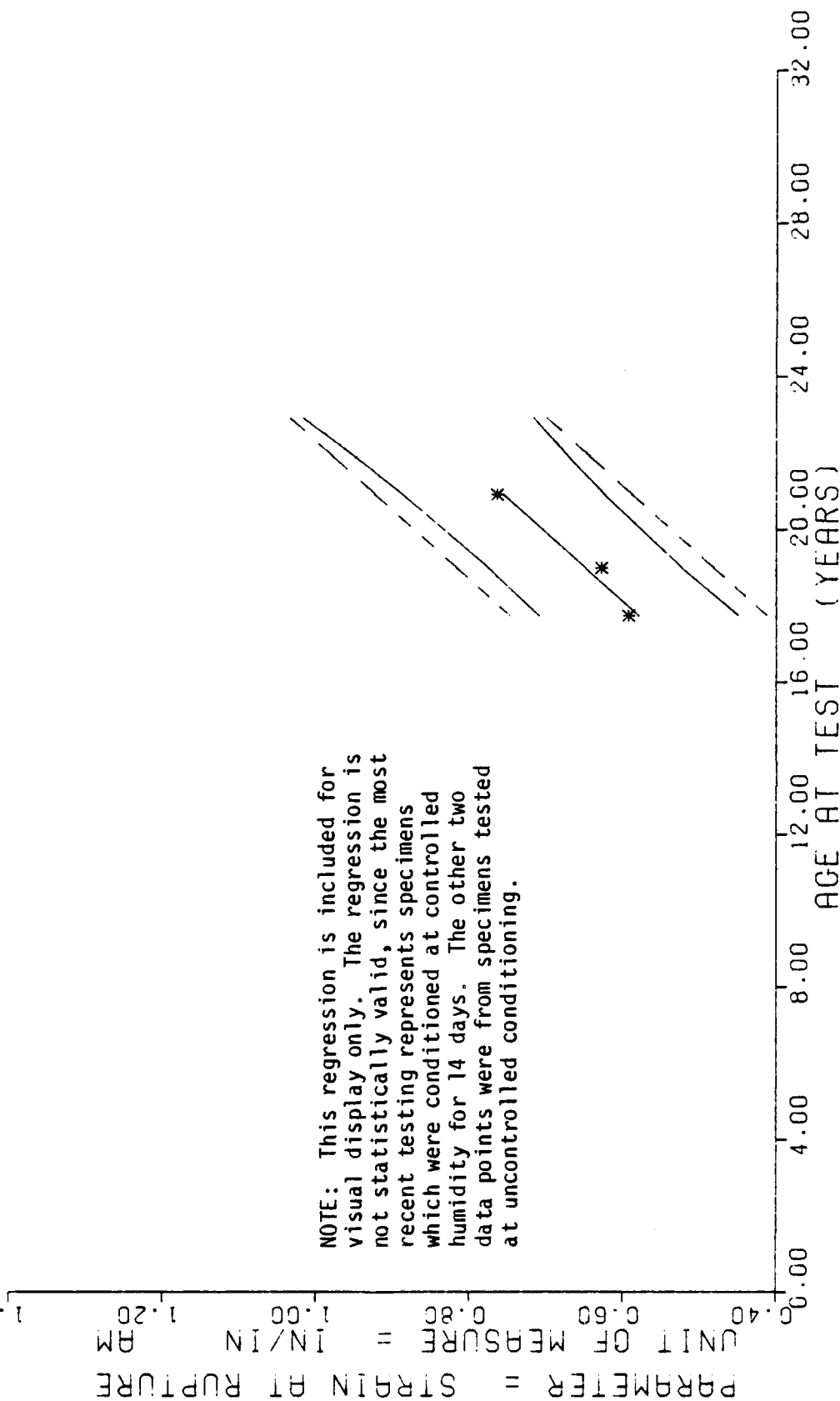
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



11 STAGE 0501 MTRS ONLY. OUTER AXIAL POS LOW RATE CHS-2 0 IN/MIN. MAX STRESS

Figure 7-B

$Y = ( (-4.0566963E-01) + ( +4.6240976E-03 ) * X )$   
 $F = +3.0226503E+01$  SIGNIFICANCE OF F = SIGNIFICANT  $G = +9.1956608E-02$   
 $R = +8.0862736E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S = +8.4107174E-04$   
 $t = +5.4978634E+00$  SIGNIFICANCE OF t = SIGNIFICANT  $St = +5.5765023E-02$   
 $N = 18$  DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = B TEMP/RH AM TEST CONDITIONS = B TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represented specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

II STAGE DSCT MIRS ONLY. OUTER, AXIAL POS. LOW RATE CHS=2.0 STN RUPTUR <0022687>

Figure 8

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (CENTS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+5.9214937E-01	+1.9773917E-02	+6.1469555E-01	+5.5490994E-01	+5.7926315E-01
223.0	6	+6.2733298E-01	+5.1973416E-02	+6.7599599E-01	+5.5509996E-01	+6.4862459E-01
251.0	6	+7.6338291E-01	+7.7664897E-02	+8.1995599E-01	+6.1109995E-01	+7.5497883E-01

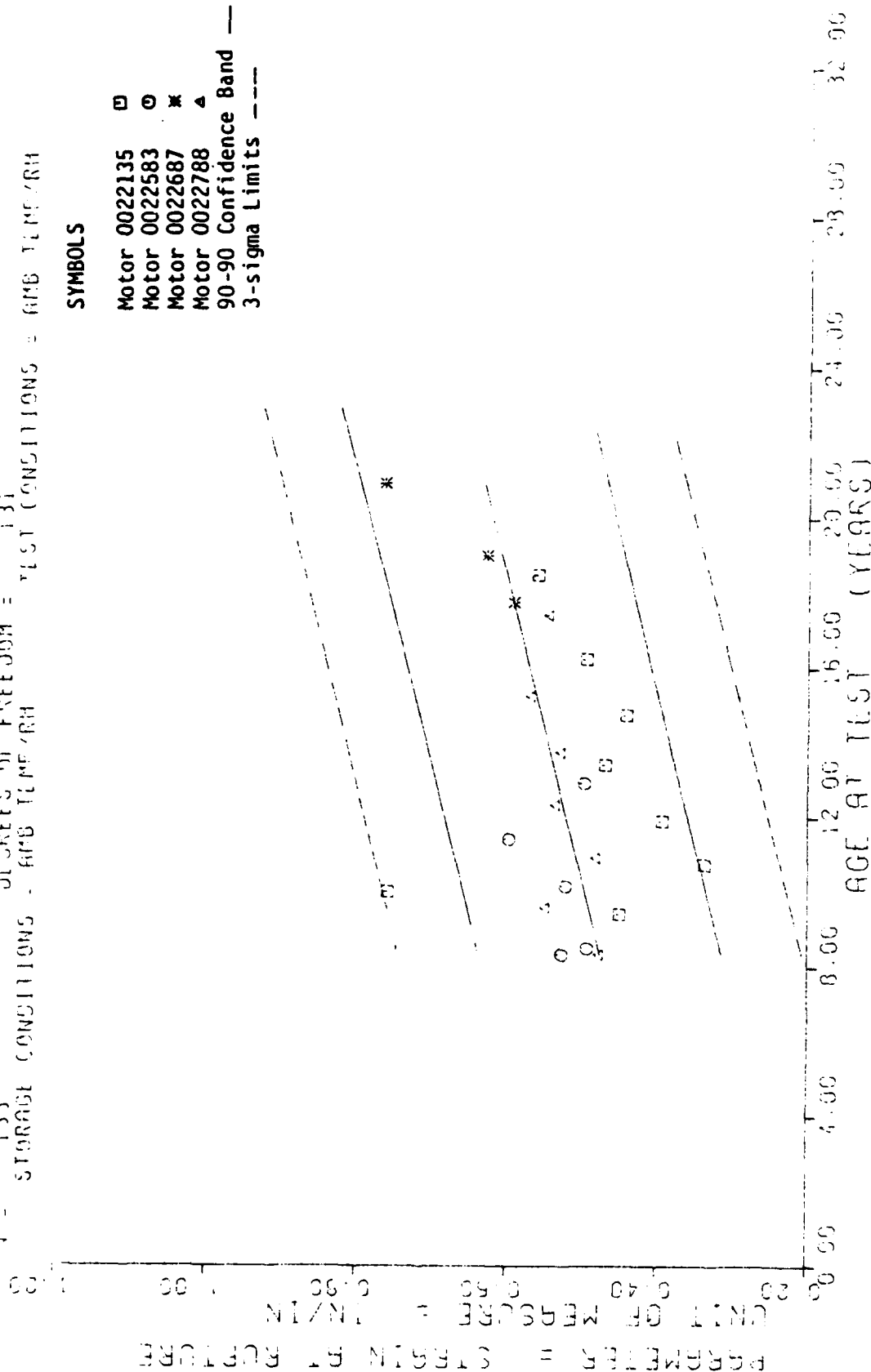
II STAGE DSCT MIRS ONLY. OUTER AXIAL PCS LCM RATE CHS=2.0 STN RUPTUR <0022697>

Figure 8-A

Y = (1) 43.720355E-03 (2) 1 (3) 0344720E-03 (4) X  
 F = +4 0872104E-01 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +5 8776553E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 A = +6 3950843E-05 SIGNIFICANCE OF A = SIGNIFICANT  
 T = 131 DEGREES OF FREEDOM = 131  
 STORAGE CONDITIONS = AMBI TEMP/HR TEST CONDITIONS = AMBI TEMP/HR

# SYMBOLS

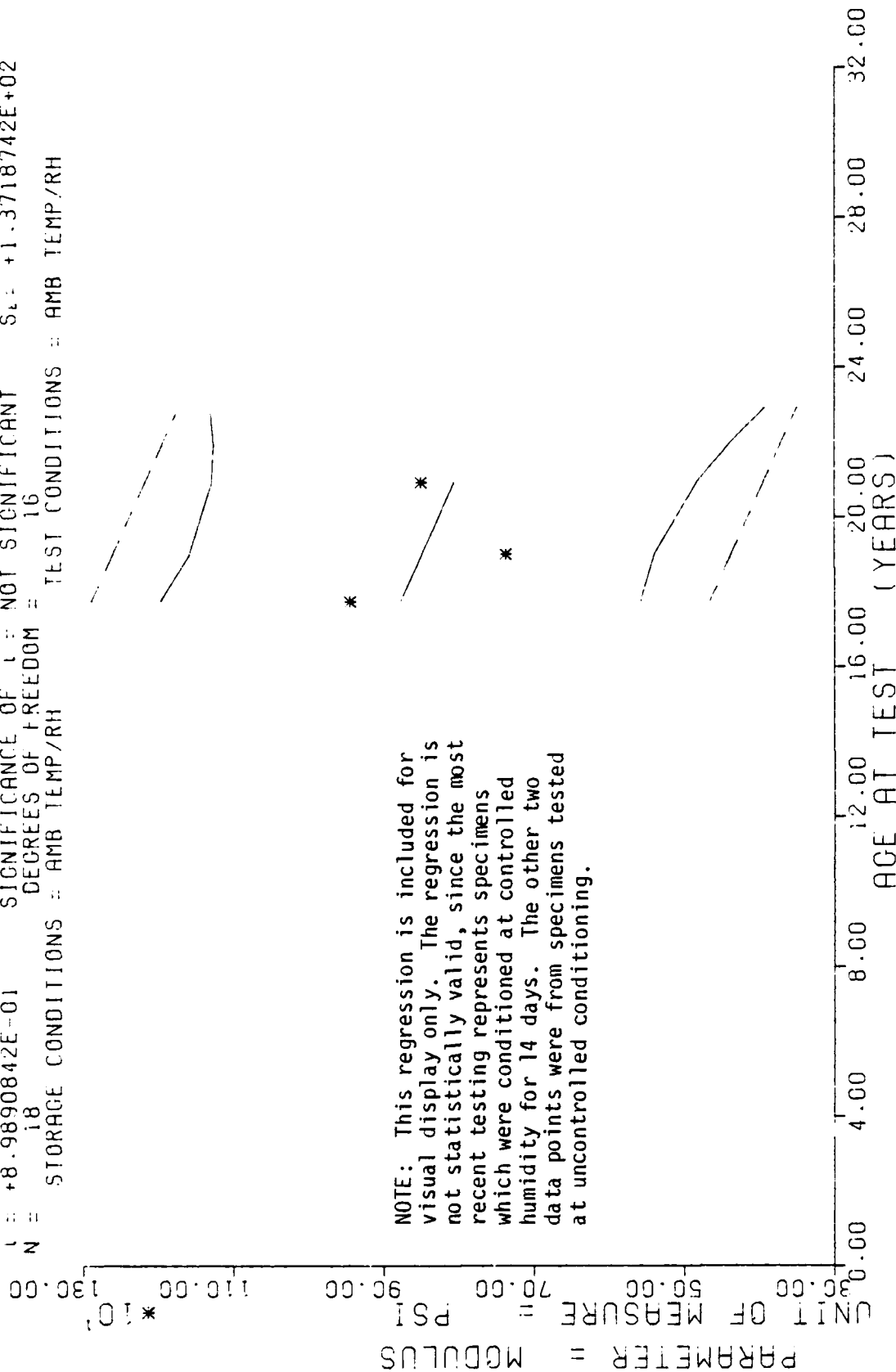
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



11 STEEL BOLT MTRG ONLY. OUTER AXIAL POS. 10% RATE (HS-2 0 IN/MIN. STRAIN/RUPURE

Figure 8-B

Y = (1 +1.2731392E+03 ) + ( -1.8599484E+00 ) \* X )  
 F = +8.0803636E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma^2$  = +1.3641066E+02  
 R = -2.1925876E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_b$  = +2.0691189E+00  
 t = +8.9890842E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_{b|}$  = +1.3718742E+02  
 N = 18 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



!! STAGE, DSCT MTRS, ONLY, OUTER, AXIAL POS, LOW RATE CHS=2.0 <0022687> MODULUS

Figure 9



\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

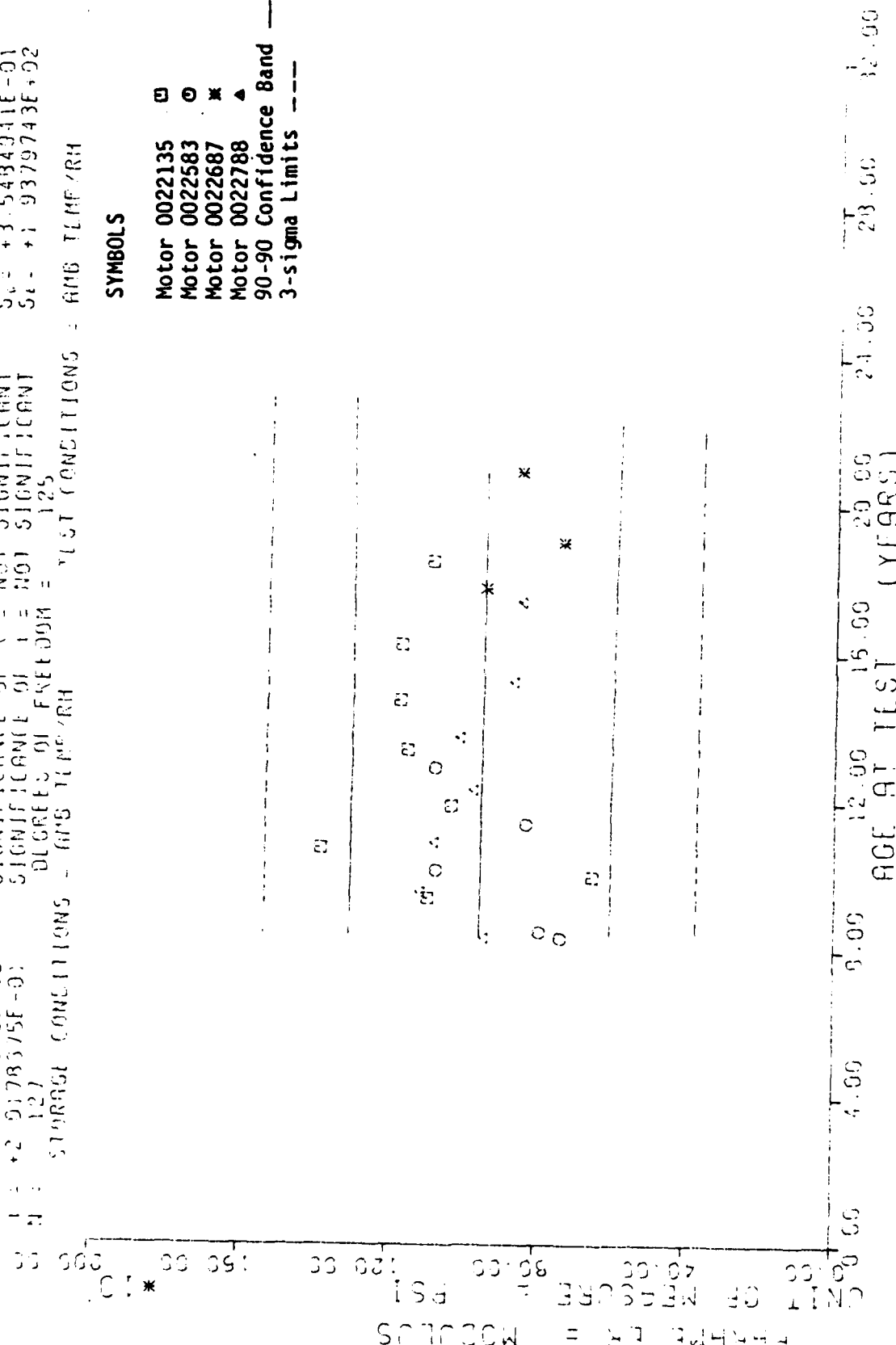
\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+5.445000E+02	+2.576135E+01	+1.045000E+03	+8.180000E+02	+8.7696997E+02
228.0	6	+7.375000E+02	+1.593245E+02	+8.790000E+02	+4.430000E+02	+8.4907080E+02
251.0	6	+8.5022225E+02	+6.361027E+01	+9.610000E+02	+7.690000E+02	+8.0629199E+02

11 STAGE, CSCT MIRS, ONLY. OUTER, AXIAL PCS, LOW RATE CHS=2.0 <0022687> MODULUS

F = +4 0715684E-02  
 R = +1 8615140E-02  
 I = +2 9178575E-03  
 N = 127  
 STORAGE CONDITIONS - 60'S TIME/RH  
 DEGREES OF FREEDOM = 125  
 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 SIGNIFICANCE OF I = NOT SIGNIFICANT  
 Y = (1 + 0.5152135E-02) (1 - 7.1602345E-02) (X)

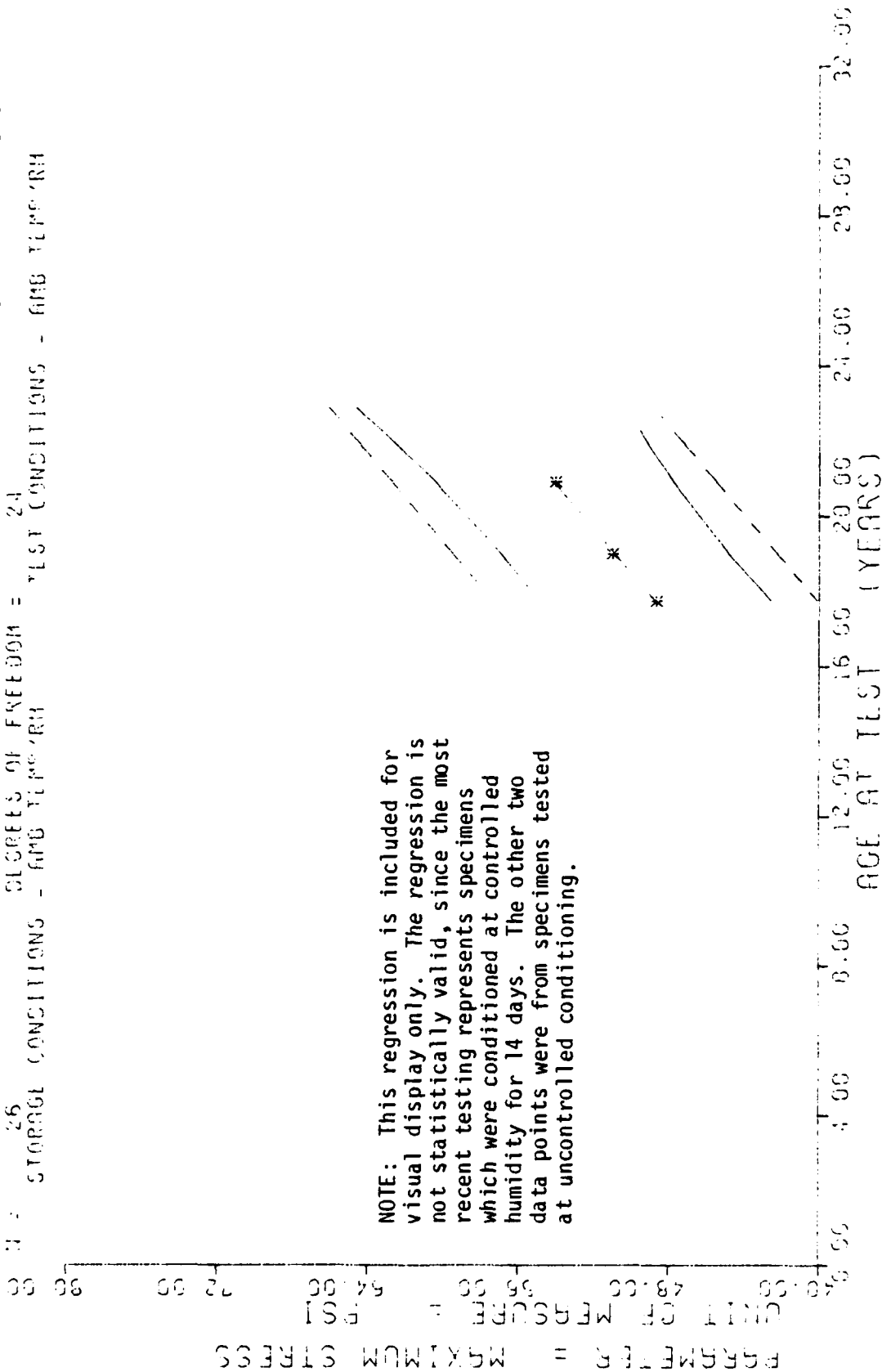
**SYMBOLS**  
 Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



11 STAGE TEST MTRS ONLY, OUTER AXIAL POS LOW RATE CHS-2.0 IN/MIN. MODULUS

Figure 9-B

Y = (C +1 3596728E-01 ) + ( +1 5143256E-01 ) \* X )  
 F = +1 3143361E+01 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +5 7496356E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +3 6254331E+00 SIGNIFICANCE OF T = SIGNIFICANT  
 D = 26 DEGREES OF FREEDOM = 24  
 STORAGE CONDITIONS - AMBI TEMP RH TEST CONDITIONS - AMBI TEMP RH



II STAGE TEST MRS. INNER AXIAL POS. V.L. RATE CHS-0 0002 MAX STRESS -00022687>

Figure 10

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	10	+4.8643920E+01	+2.1851710E+00	+5.1019589E+01	+4.4000000E+01	+4.8721862E+01
223.0	10	+5.0571939E+01	+4.1117136E+00	+5.6049587E+01	+4.4769989E+01	+5.0843353E+01
251.0	6	+5.4011627E+01	+7.2418703E-01	+5.5069552E+01	+5.3079986E+01	+5.4096298E+01

II STAGE DSCT MPRS, INNER, AXIAL POS, V.L. RATE CHS=0.0002 MAX STRESS <0022687>

Figure 10-A

F = +5 0921730E-06 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +1 3597308E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +2 6271987E-06 SIGNIFICANCE OF T = SIGNIFICANT  
 D = 175 DEGREES OF FREEDOM = 173  
 STORAGE CONDITIONS = 60% TEMPER RH TEST CONDITIONS = 60% TEMPER RH

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----

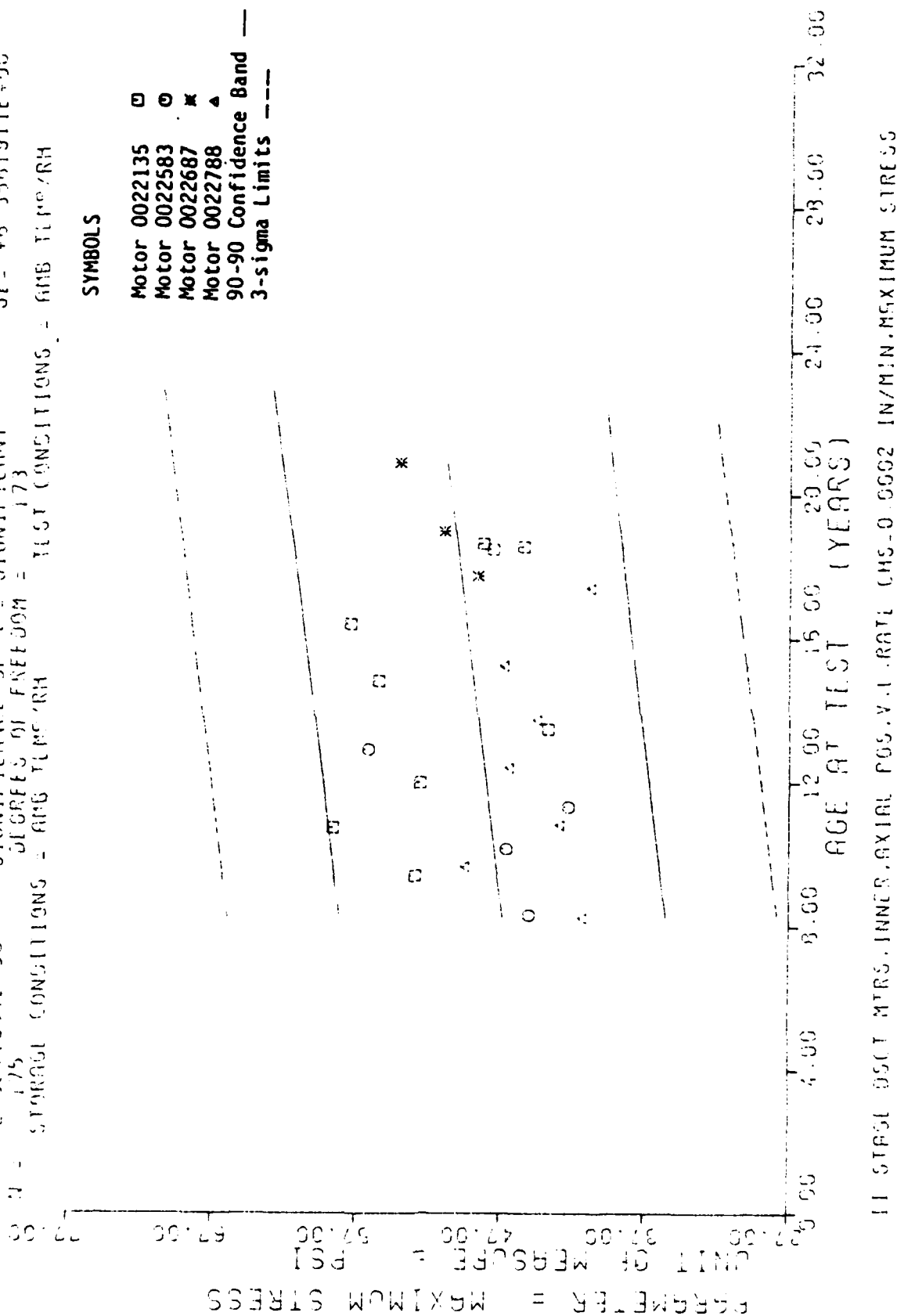
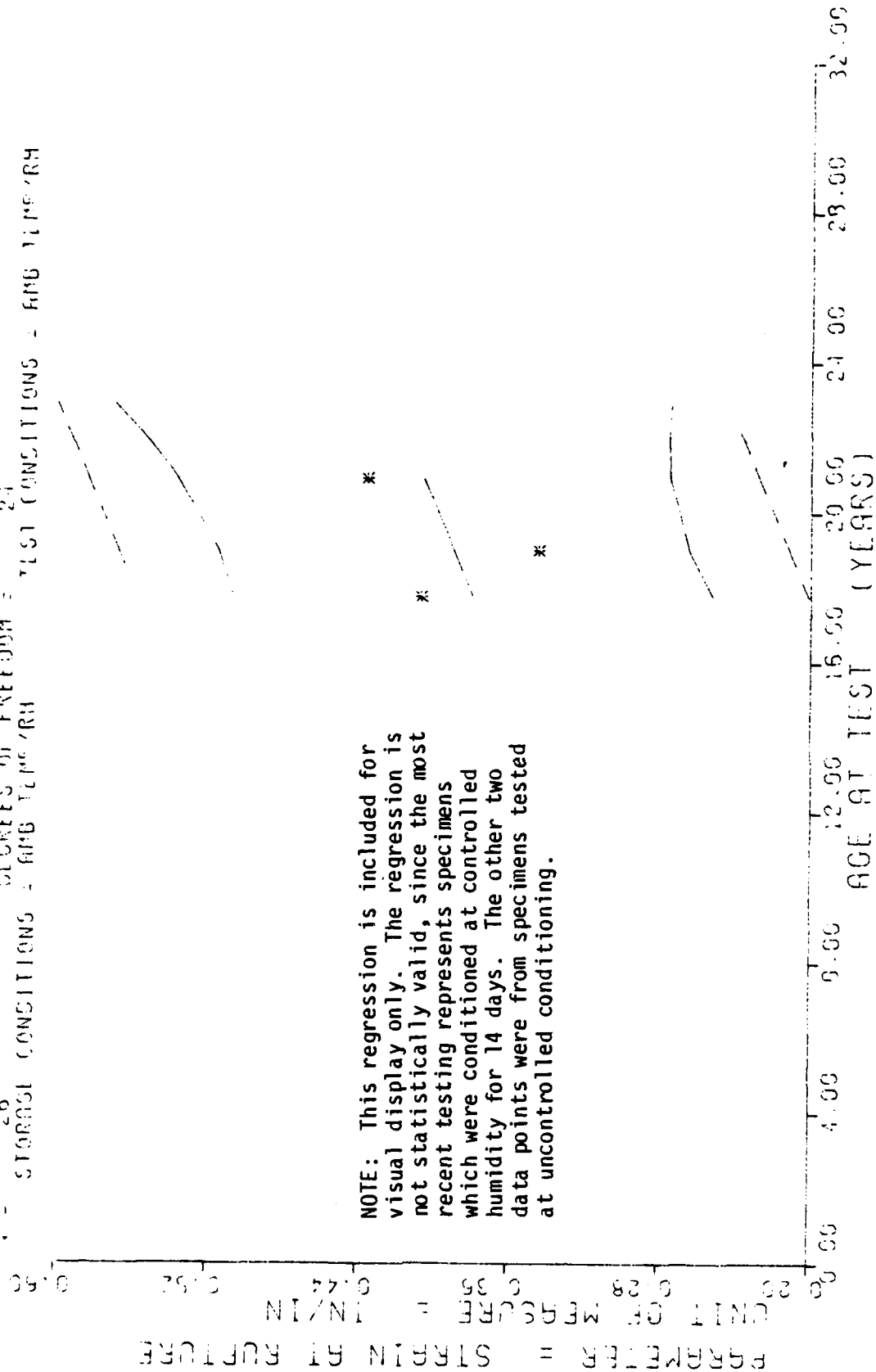


Figure 10-B



Y = (1.42 32475061-01) 1.16 89253261-04 1.1 X)  
 F = 17 2977713E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT S1 = 15 0969294E-02  
 R = 11 7173402E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S2 = 18 66833061-04  
 T = 13 5426997E-01 SIGNIFICANCE OF T = NOT SIGNIFICANT S3 = 15 0391143E-02  
 26  
 STORAGE CONDITIONS = 6MB TEMP/RH TEST CONDITIONS = 6MB TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

11 STAGE 05CT NTR <09222687>. INNER AXIAL FOS.V.L. RATE CHS-0.0002 STRAIN RUPTURE

Figure 11

\*\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PLR GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	10	+4.0659970E-01	+1.4653066E-02	+4.2199996E-01	+3.8399994E-01	+3.7928700E-01
228.0	10	+3.4449976E-01	+7.2915583E-02	+4.3499994E-01	+2.4199998E-01	+3.8962578E-01
251.0	6	+4.3512618E-01	+1.9464521E-02	+4.6299999E-01	+4.0499997E-01	+4.0547859E-01

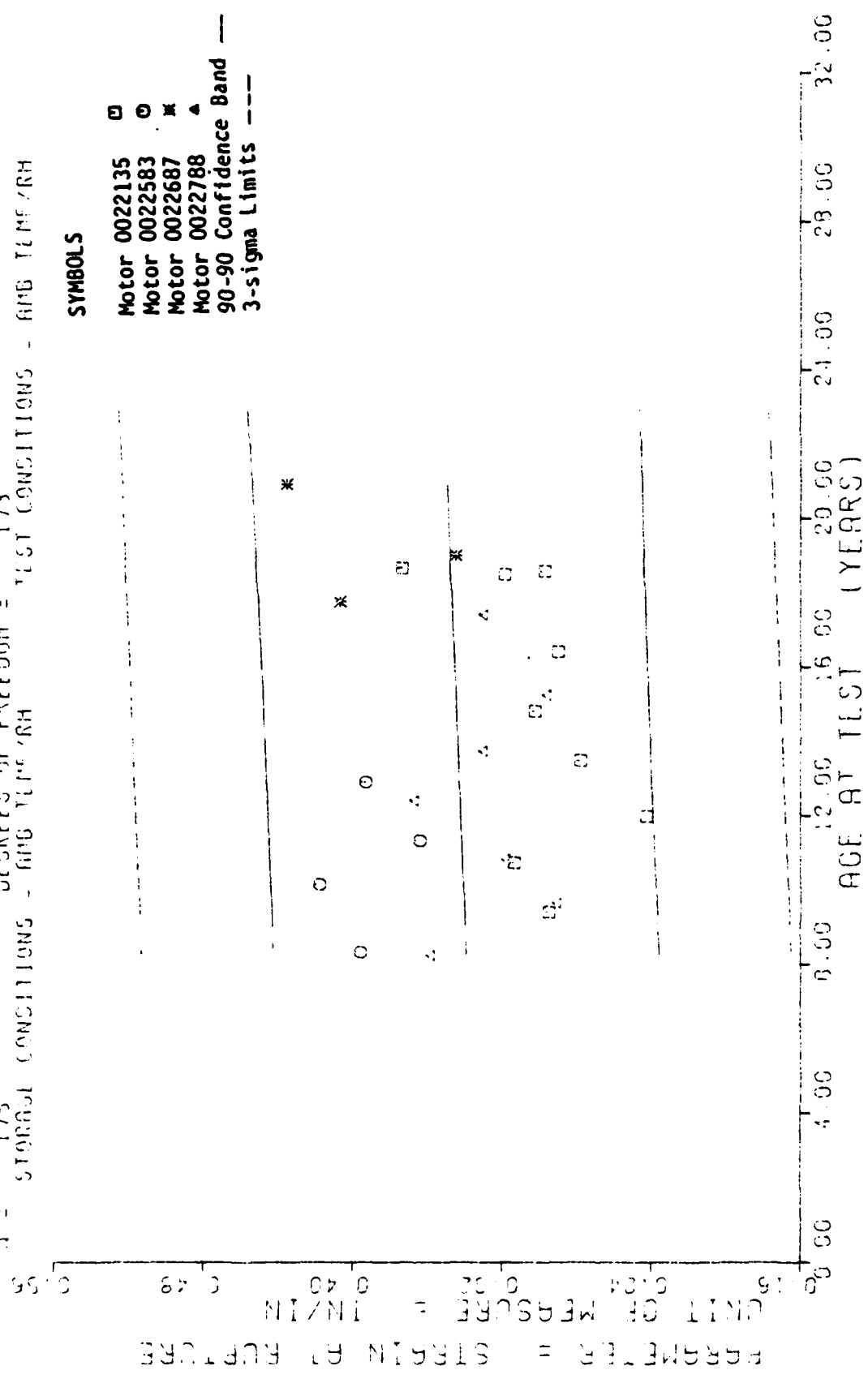
II STAGE DSCT MTR <0022687>, INNER, AXIAL PCS.V.L.RATE CHS=0.0002, STRAIN RUPTURE.

Figure 11-A



Y = 11 43 322013E-01 J = 1 46 3110014E-05 J \* X)  
 F = +5 7556735E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT S<sub>1</sub> = +5.7325305E-02  
 R = +5 7574285E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S<sub>2</sub> = +8.9792148E-05  
 T = +7 5952572E-01 SIGNIFICANCE OF T = NOT SIGNIFICANT S<sub>3</sub> = +5.7996116E-02  
 H = 175 DEGREES OF FREEDOM = 173  
 STORAGE CONDITIONS - AND TEMP/RH TEST CONDITIONS - AND TEMP/RH

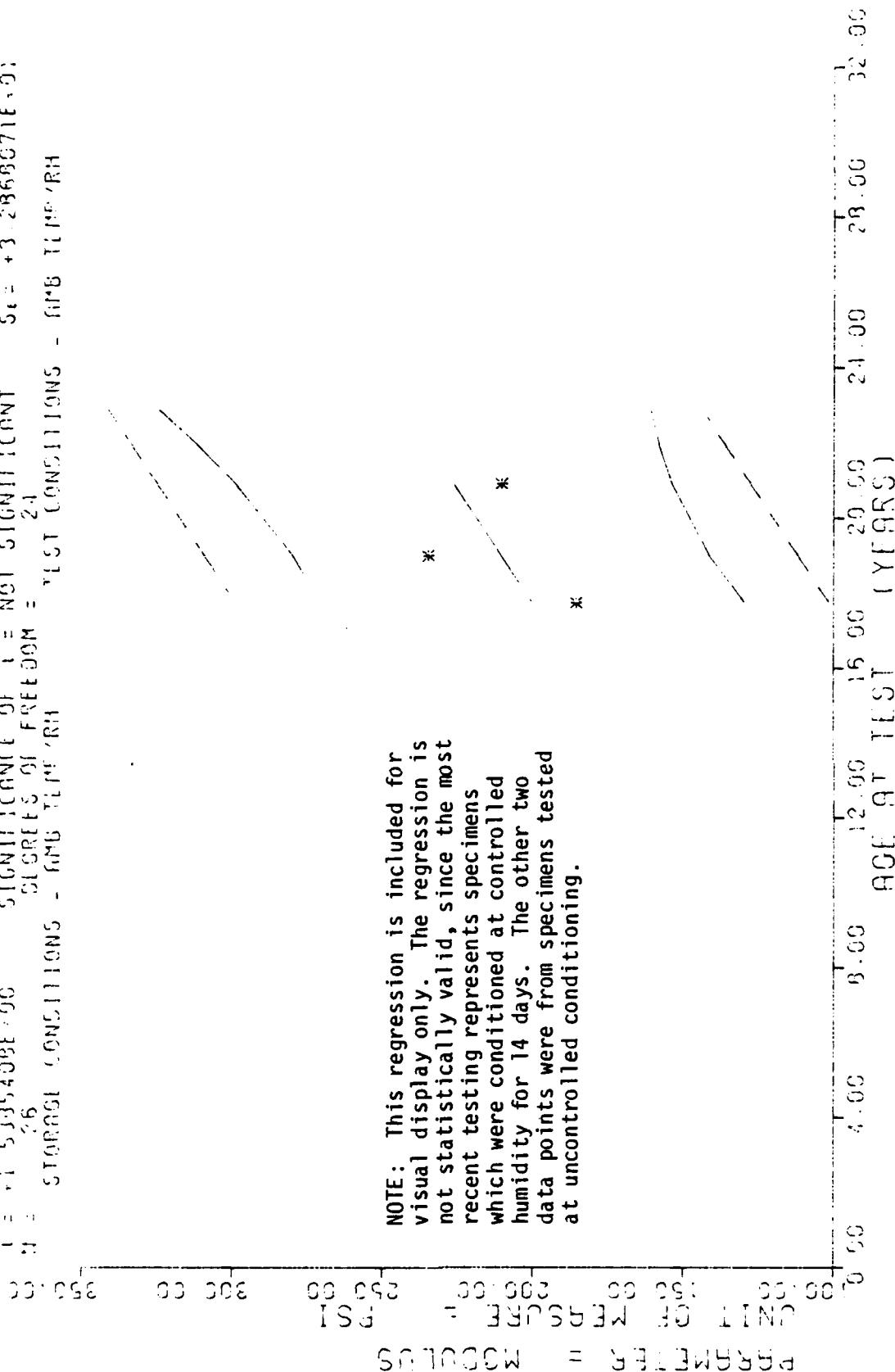
**SYMBOLS**  
 Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



11 STAGE DUCT MTRG. INNER AXIAL POS. V L. RATE CHS-0.0002 IN/MIN. STRAIN/RUPTURE

Figure 11-B

F = +2 3671028E+00  
 R = +2 0062431E-01  
 T = +1 5395408E+00  
 D = 26  
 STORAGE CONDITIONS - RMS TEMP RH  
 Y = (1 +5.3899556E-01) + (-16.3608132E-01) (X)  
 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 SIGNIFICANCE OF T = NOT SIGNIFICANT  
 DEGREES OF FREEDOM = 24  
 TEST CONDITIONS - RMS TEMP RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

II STAGE 05CT MTR <0022687>, INNER AXIAL POS, V.I. RATE CHS-0 0002 MODULUS

Figure 12

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

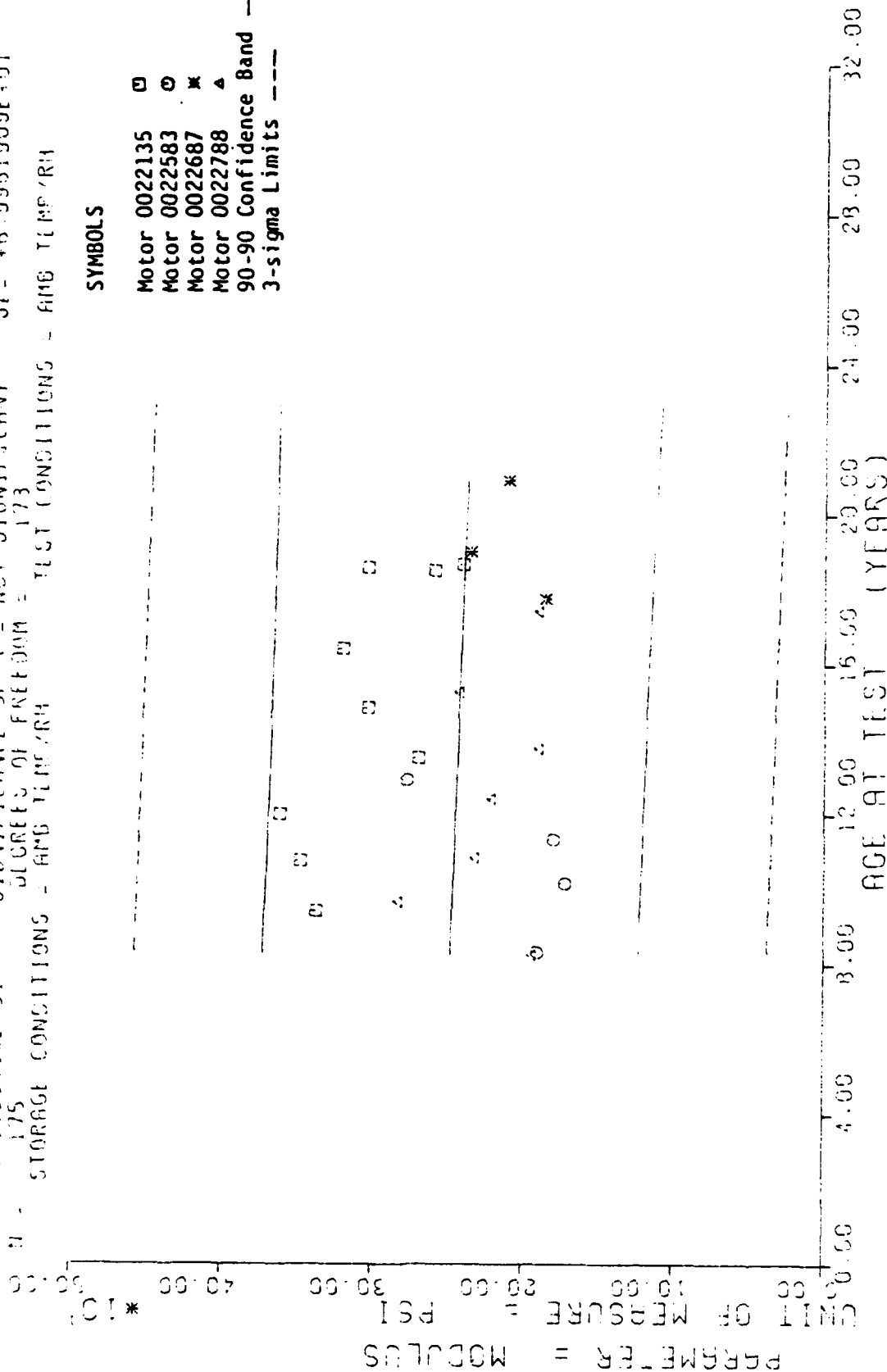
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	10	+1.855000E+02	+5.2121652E+00	+1.9700000E+02	+1.7900000E+02	+2.0012771E+02
229.0	10	+2.3459599E+02	+4.2261619E+01	+3.0900000E+02	+1.8700000E+02	+2.1043244E+02
251.0	6	+2.1033332E+02	+4.7187568E+00	+2.1700000E+02	+2.0300000E+02	+2.2623303E+02

II STAGE USCT MTR <0022687>. INNER, AXIAL PCS, V.L. RATE CHS=0.0002, MCDULUS.

F = +4.0263415E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 R = +4.8196730E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 T = +6.3453450E-01 SIGNIFICANCE OF T = NOT SIGNIFICANT  
 D = 175 DEGREES OF FREEDOM = 173  
 STORAGE CONDITIONS = AMBI TEMP/RH TEST CONDITIONS = AMBI TEMP/RH

# SYMBOLS

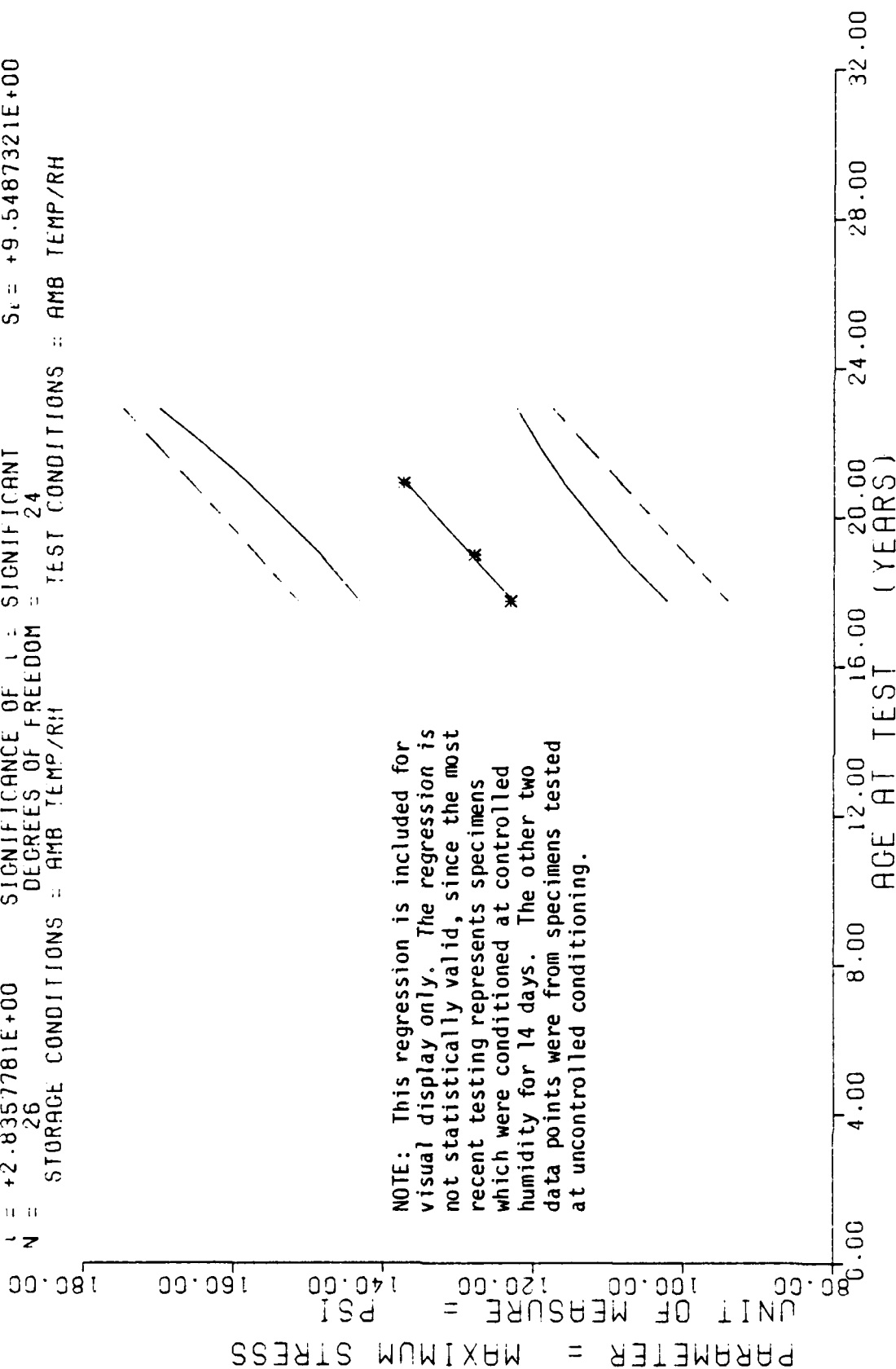
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



II STAGE 050T MRS. INNER AXIAL POS. V.I. RATE (HS-0 6602 IN/MIN. MODULUS)

Figure 12-B

$Y = ( (+4.2788408E+01) + ( +3.755410E-01 ) * X )$   
 $F = +8.0416374E+00$  SIGNIFICANCE OF F = SIGNIFICANT  $G_r = +1.0810183E+01$   
 $R = +5.0097366E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_B = +1.3243423E-01$   
 $L = +2.8357781E+00$  SIGNIFICANCE OF L = SIGNIFICANT  $S_L = +9.5487321E+00$   
 $N = 26$  DEGREES OF FREEDOM = 24  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



II STAGE DSCT MRS ONLY, INNER, AXIAL, POS. LOW RATE CHS=2.0 MAX STRESS <0022687>

Figure 13

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	9	+1.2311059E+02	+4.7583309E+00	+1.3032558E+02	+1.1590598E+02	+1.2278141E+02
222.0	11	+1.2756396E+02	+1.3983126E+01	+1.4388999E+02	+1.0908999E+02	+1.2841473E+02
251.0	6	+1.3727487E+02	+2.5658289E+00	+1.4307598E+02	+1.3526998E+02	+1.3705247E+02

II STAGE ESCT MRS ONLY. INNER AXIAL PLS LOW RATE CFS=2.0 MAX STRESS <00226H7>

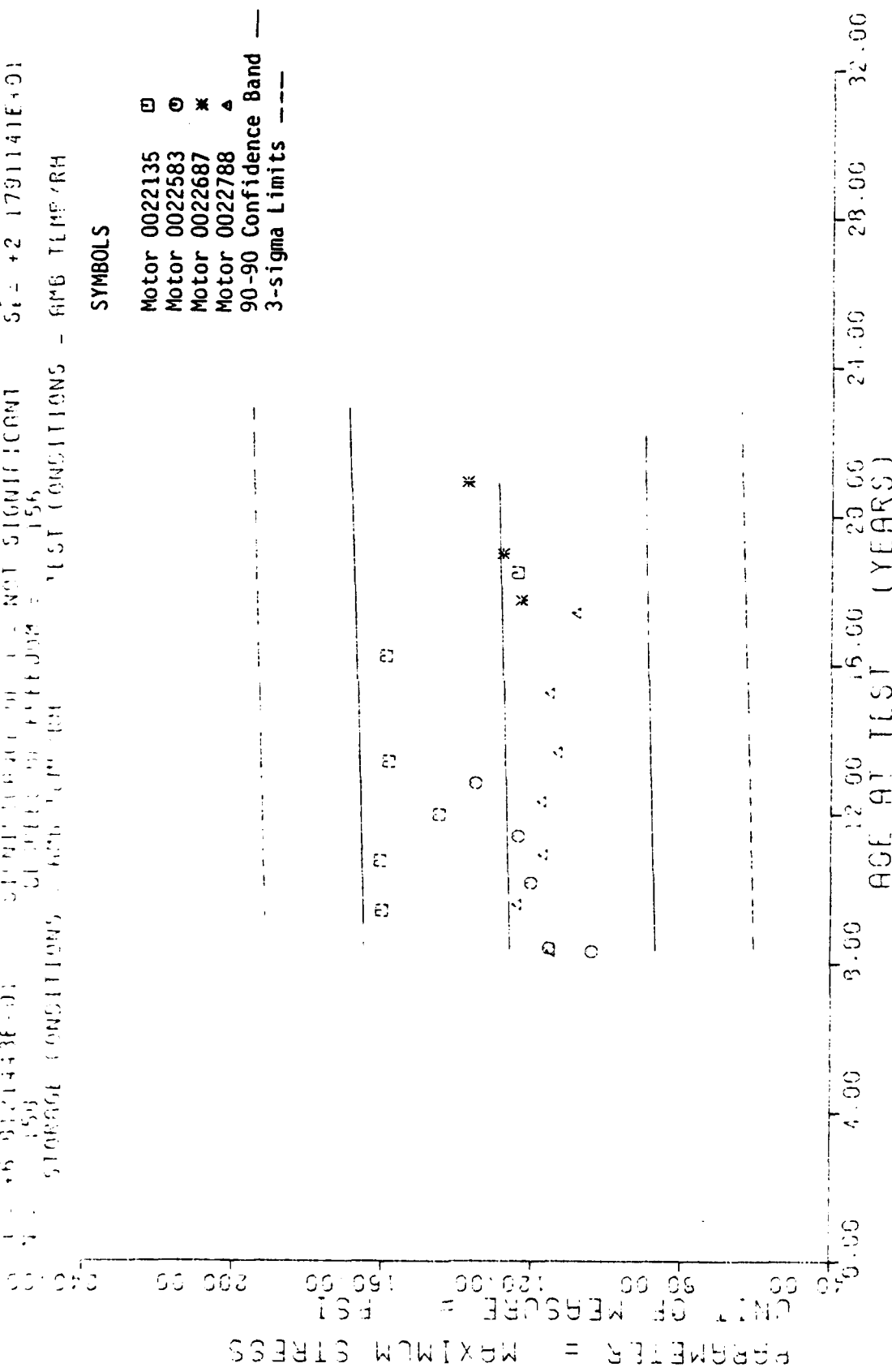
Figure 13-A

[illegible][illegible]

HR, 3171 945 - 506111500) 1531, 103.6071, 9.39 - 506111500) 1953015

## SYMBOLS

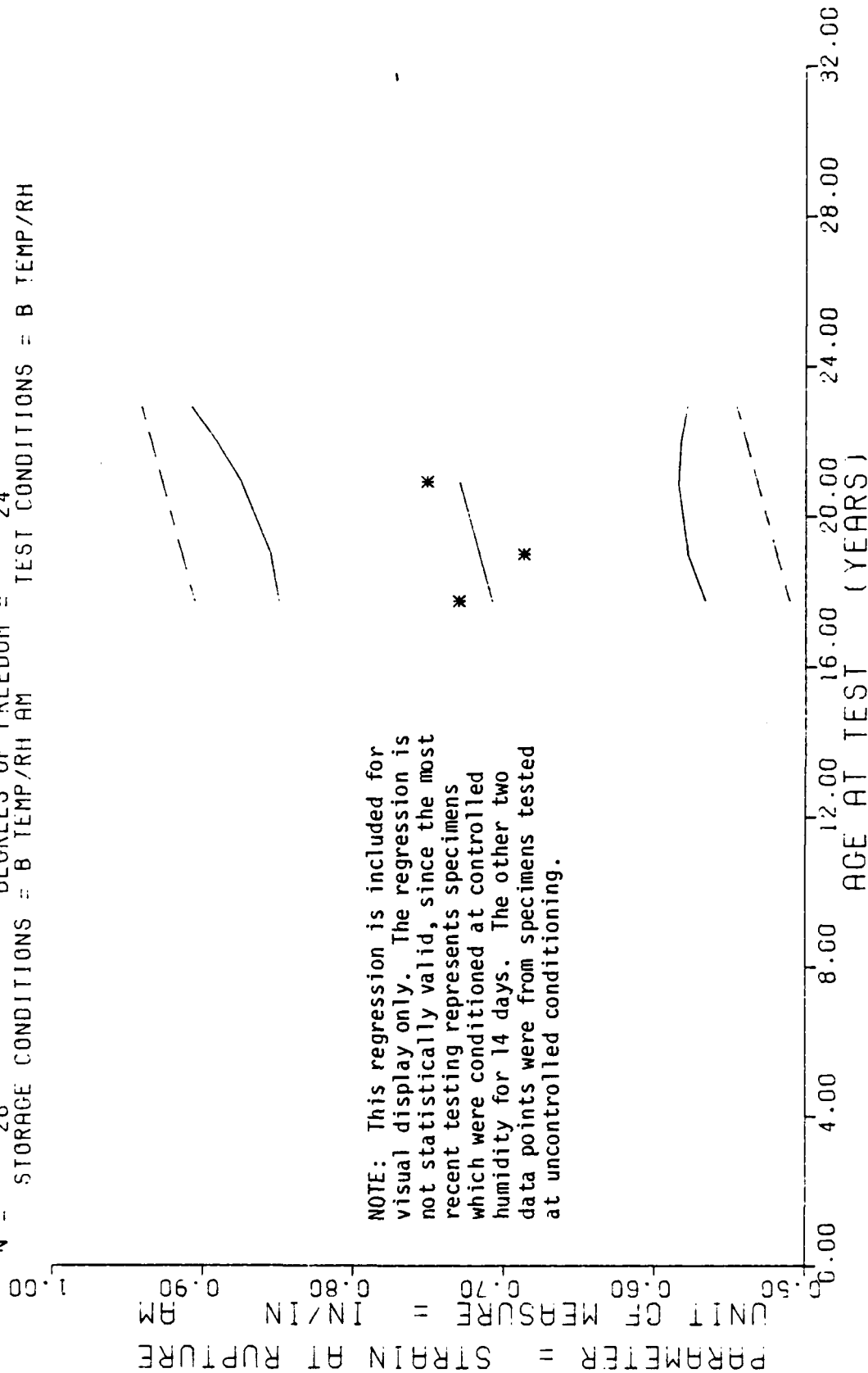
Motor	0022135	□
Motor	0022583	○
Motor	0022687	✱
Motor	0022788	▲
90-90 Confidence B		
3-sigma Limits		



11 STAGE 9501 MTRS. ONLY, INNER AXIAL PPS LOW RATE CHS-2.0 IN/MIN. MAX STRESS

**Figure 13-B**

$Y = (( +3.7998062E-01 ) + ( +5.8842376E-01 ) + ( +5.6361188E-04 ) * X)$   
 F = +3.7998062E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma_y = +6.5101581E-02$   
 R = +1.2484295E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_b = +9.1432251E-04$   
 t = +6.1642568E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_e = +6.5924199E-02$   
 N = 26 DEGREES OF FREEDOM = 24  
 STORAGE CONDITIONS = B TEMP/RH AM TEST CONDITIONS = B TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

II STAGE DUCT MTRS ONLY, INNER AXIAL POS. LOW RATE CHS=2.0 SIN RUPTUR <0022687>

Figure 14



\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	9	+7.3047721E-01	+4.0140348E-02	+8.1099999E-01	+6.7459994E-01	+7.0847308E-01
229.0	11	+6.8718135E-01	+8.1737301E-02	+8.1799995E-01	+5.8529996E-01	+7.1692723E-01
251.0	6	+7.5141632E-01	+3.9137815E-02	+7.5889994E-01	+6.9299995E-01	+7.2989034E-01

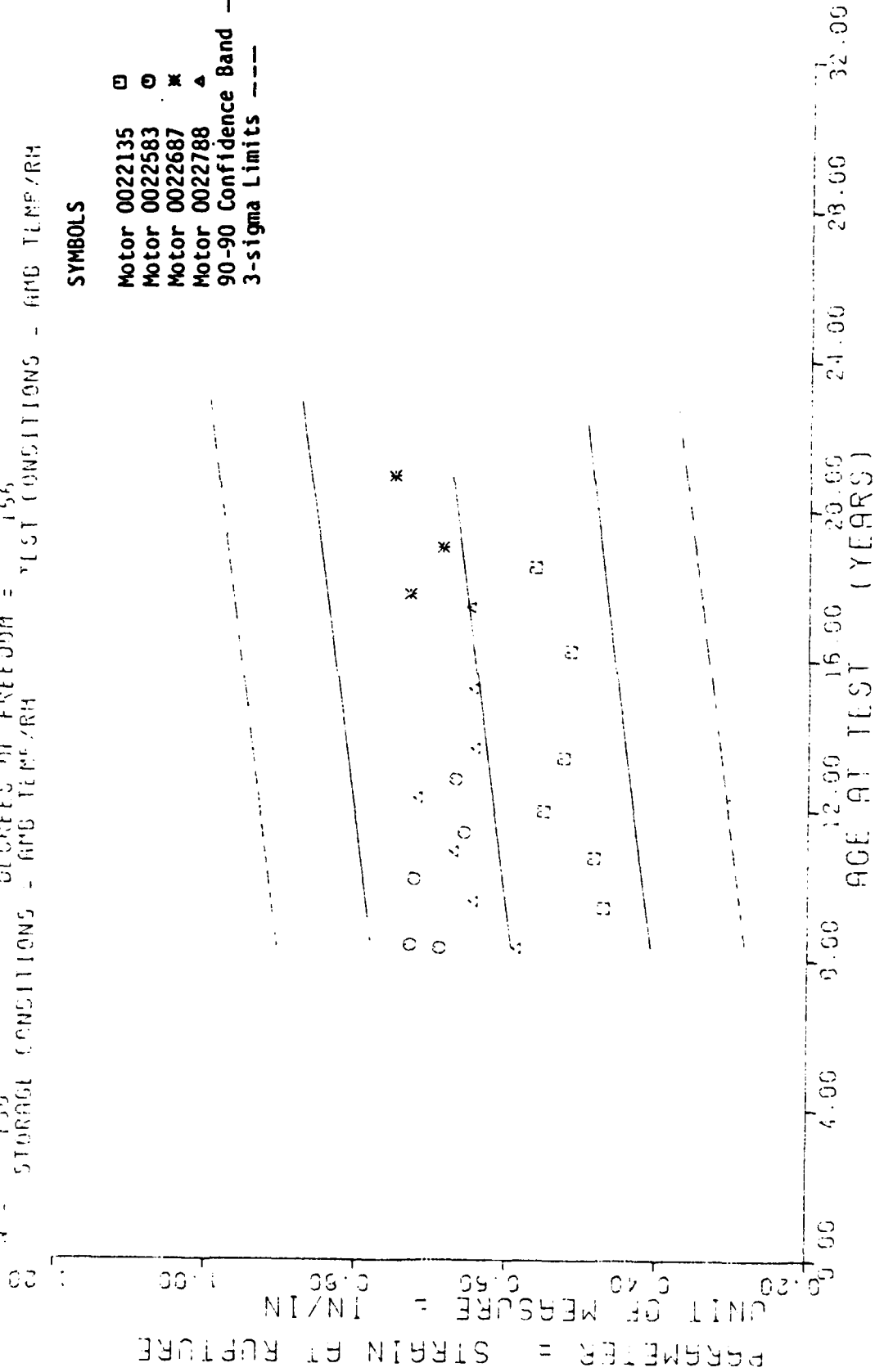
II STAGE DSCF WIPS ONLY, INNER, AXIAL PCS, LOW RATE CFS=2.0 STN RUPTUR <0022687>

Figure 14-A

F = +1 1273453E-01  
 R = +2 5961157E-01  
 U = +3 3576716E-00  
 W = 159  
 STORAGE CONDITIONS = RMS TEMP/RH  
 Y = (1 +5 4957414E-01) \* ( +5 3643320E-04 ) \* X  
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF R = SIGNIFICANT  
 SIGNIFICANCE OF U = SIGNIFICANT  
 DEGREES OF FREEDOM = 156  
 TEST CONDITIONS = RMS TEMP/RH

# SYMBOLS

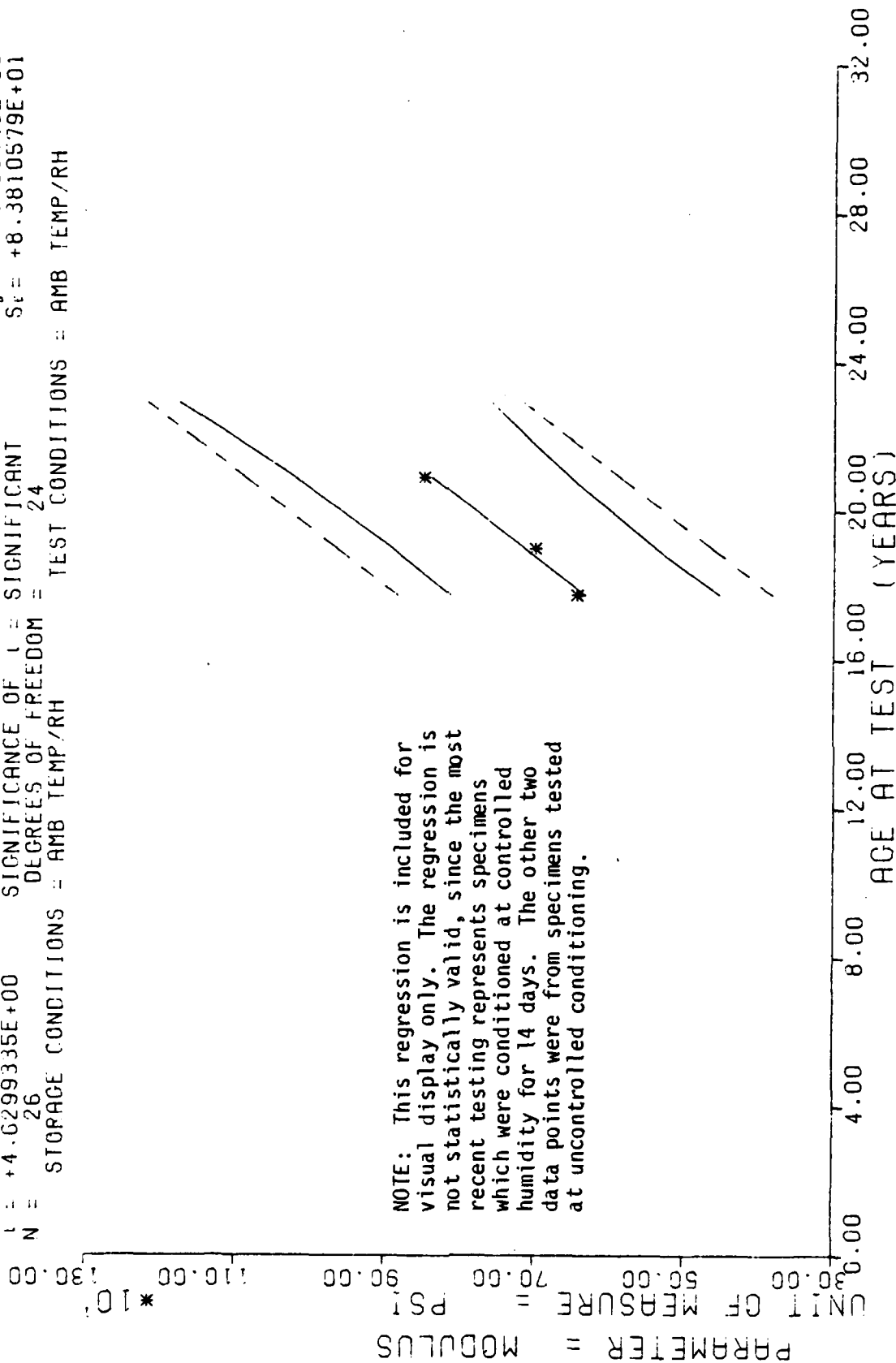
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band —  
 3-sigma Limits ----



11 STAGE DISCT MIRS. ONLY. INNER AXIAL POS LOW RATE CHS-2 0 IN/MIN. STRAIN/RUPTURE

Figure 14-B

$\hat{Y} = ((-5.1305768E+02) + (+5.3818074E+00) * X)$   
 $F = +2.1436284E+01$  SIGNIFICANCE OF F = SIGNIFICANT  $G_1 = +1.1298746E+02$   
 $R = +6.8686810E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_0 = +1.1623940E+00$   
 $L = +4.6299335E+00$  SIGNIFICANCE OF L = SIGNIFICANT  $S_1 = +8.3810579E+01$   
 $N = 26$  DEGREES OF FREEDOM = 24  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

II STAGE, DSCT MIRS, ONLY, INNER, AXIAL POS, LOW RATE CHS=2.0 <0022687> MODULUS

Figure 15

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	9	+6.4288867E+02	+6.2139851E+01	+7.0600000E+02	+5.6100000E+02	+6.3326708E+02
223.0	11	+6.9963623E+02	+1.1200285E+02	+8.9400000E+02	+5.7000000E+02	+7.1399438E+02
241.0	6	+8.4816650E+02	+3.5465036E+01	+8.8600000E+02	+8.0100000E+02	+8.3777587E+02

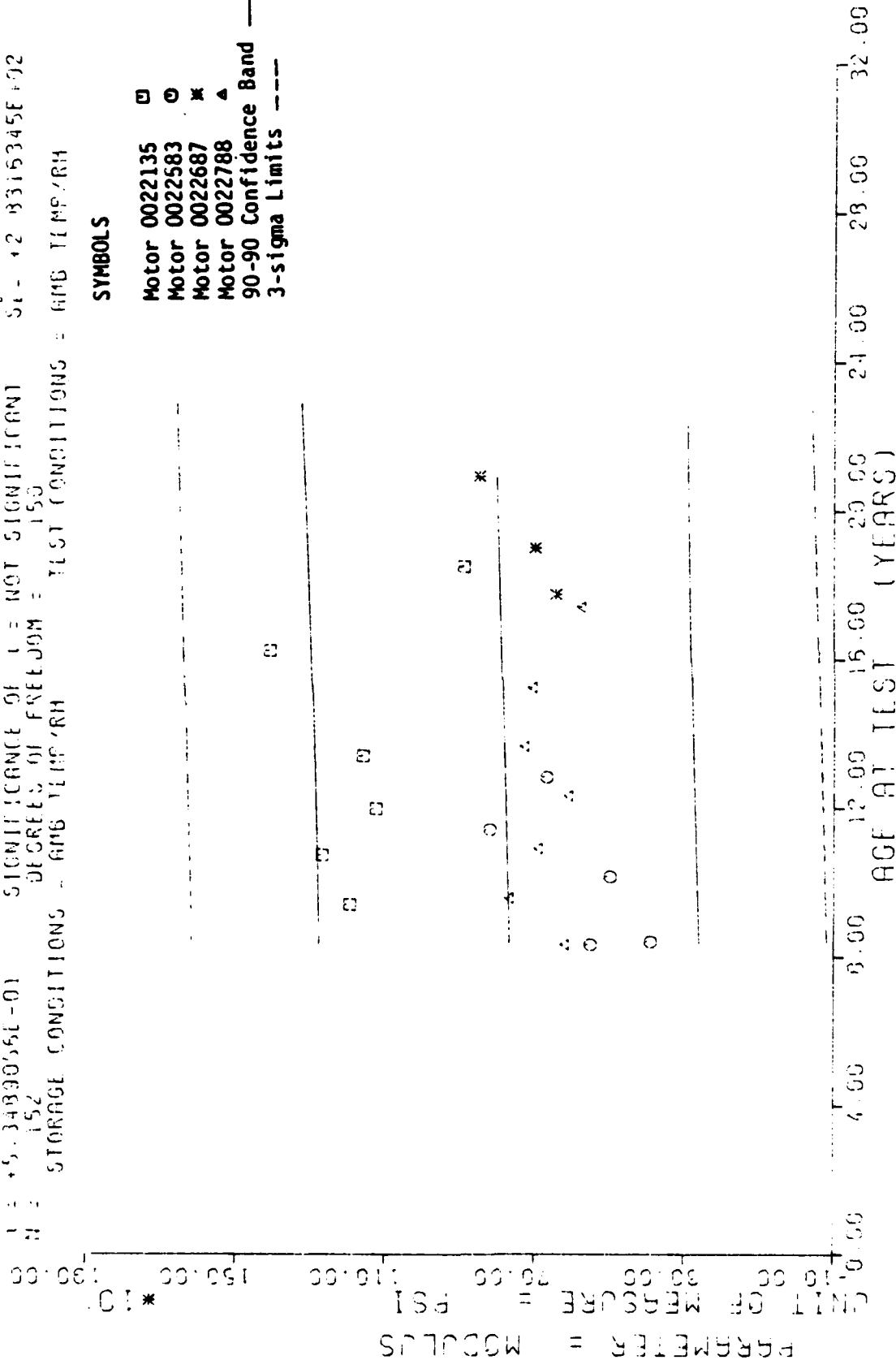
II STAGE, CSCT MIRS, ONLY. INNER, AXIAL PCS, LOW RATE CHS=2.0 <0022687> MODULUS

Figure 15-A

F = +2.8610791E-01  
 R = +4.3632039E-02  
 S = +5.3489066E-01  
 N = 152  
 STORAGE CONDITIONS = 6MB TEMP/RH  
 DEGREES OF FREEDOM = 150  
 TEST CONDITIONS = 6MB TEMP/RH

# SYMBOLS

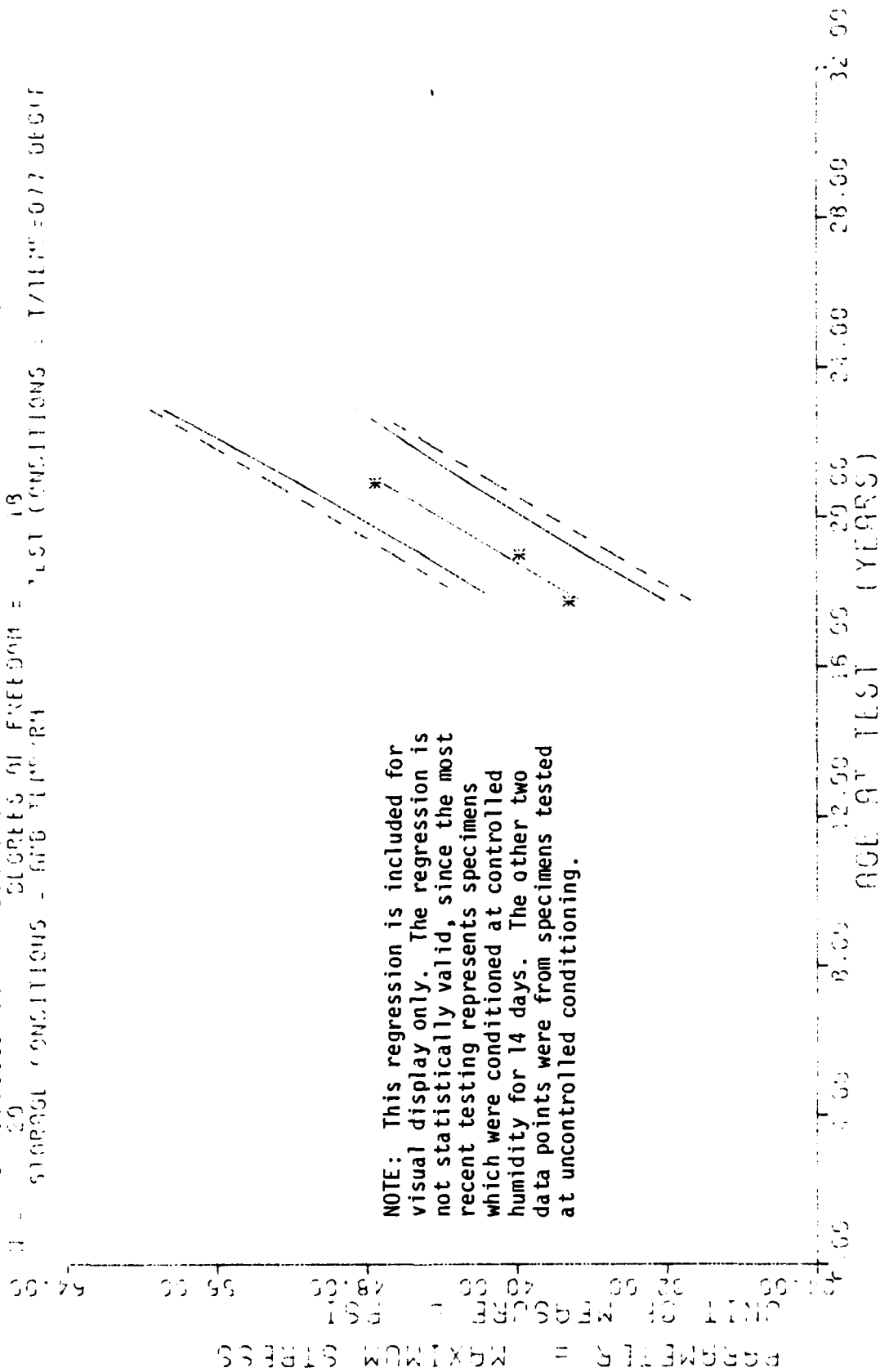
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



11 STAGE 9501 MTRS. ONLY. INNER. AXIAL POS LOW RATE CHS-2 0 IN/MIN. MODULUS

Figure 15-B

F = +8.95, 683.4E-01  
 R = +0.12, 666.9E-01  
 T = +0.46, 333.5E-06  
 U = +0.20  
 STORAGE CONDITIONS = 60% HUMIDITY  
 T = +0.25, 442.7E-01  
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF T = SIGNIFICANT  
 SIGNIFICANCE OF U = SIGNIFICANT  
 SIGNIFICANCE OF V = SIGNIFICANT  
 SCORES OF FREEDOM = 18  
 TEST CONDITIONS = 70% HUMIDITY



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

11 STAGE 0507 MTR. 81-PROP. CHS-10002 T/TEMP=07/0100(F) MAX STR=0922687>

Figure 16

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+3.7234985E+01	+2.2073582E+00	+4.1239590E+01	+3.5000000E+01	+3.6551559E+01
228.0	8	+3.5864990E+01	+2.193991E+00	+4.2539593E+01	+3.5969985E+01	+4.0711853E+01
251.0	6	+4.7536651E+01	+3.1155856E-01	+4.7919598E+01	+4.7199996E+01	+4.7090942E+01

II STAGE DSCT MTR.

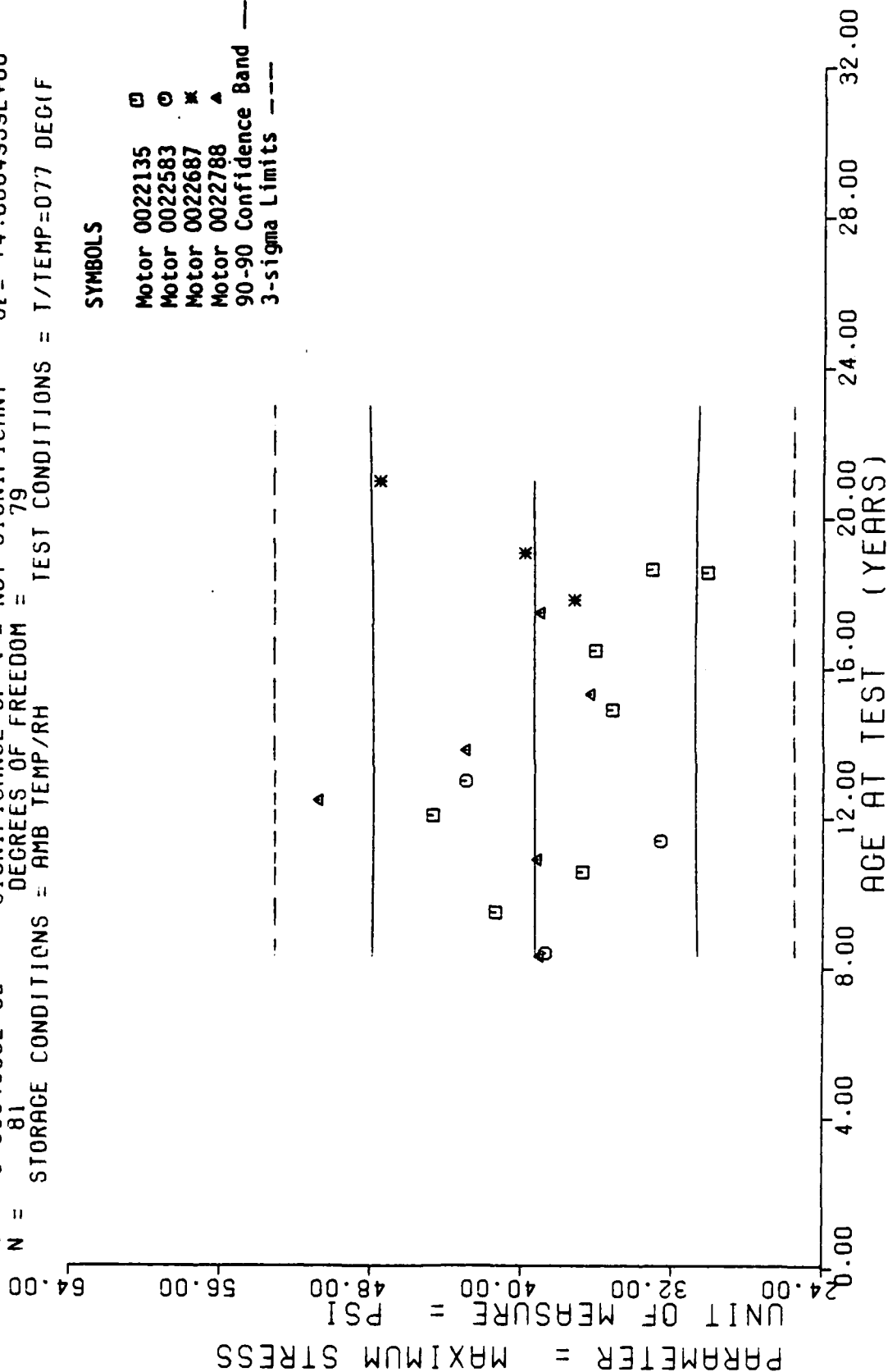
BI-PROP,CHS=.0002,I/TEMP=077DEG(F),MAX STR<0022687>

Figure 16-A

$Y = ((+3.9226130E+01) + (+5.8239123E-04) * X)$   
 F = +3.6403120E-03 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 R = +6.7880613E-03 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 I = +6.0334998E-02 SIGNIFICANCE OF I = NOT SIGNIFICANT  
 N = 81 DEGREES OF FREEDOM = 79  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = T/TEMP=077 DEG(F)

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----

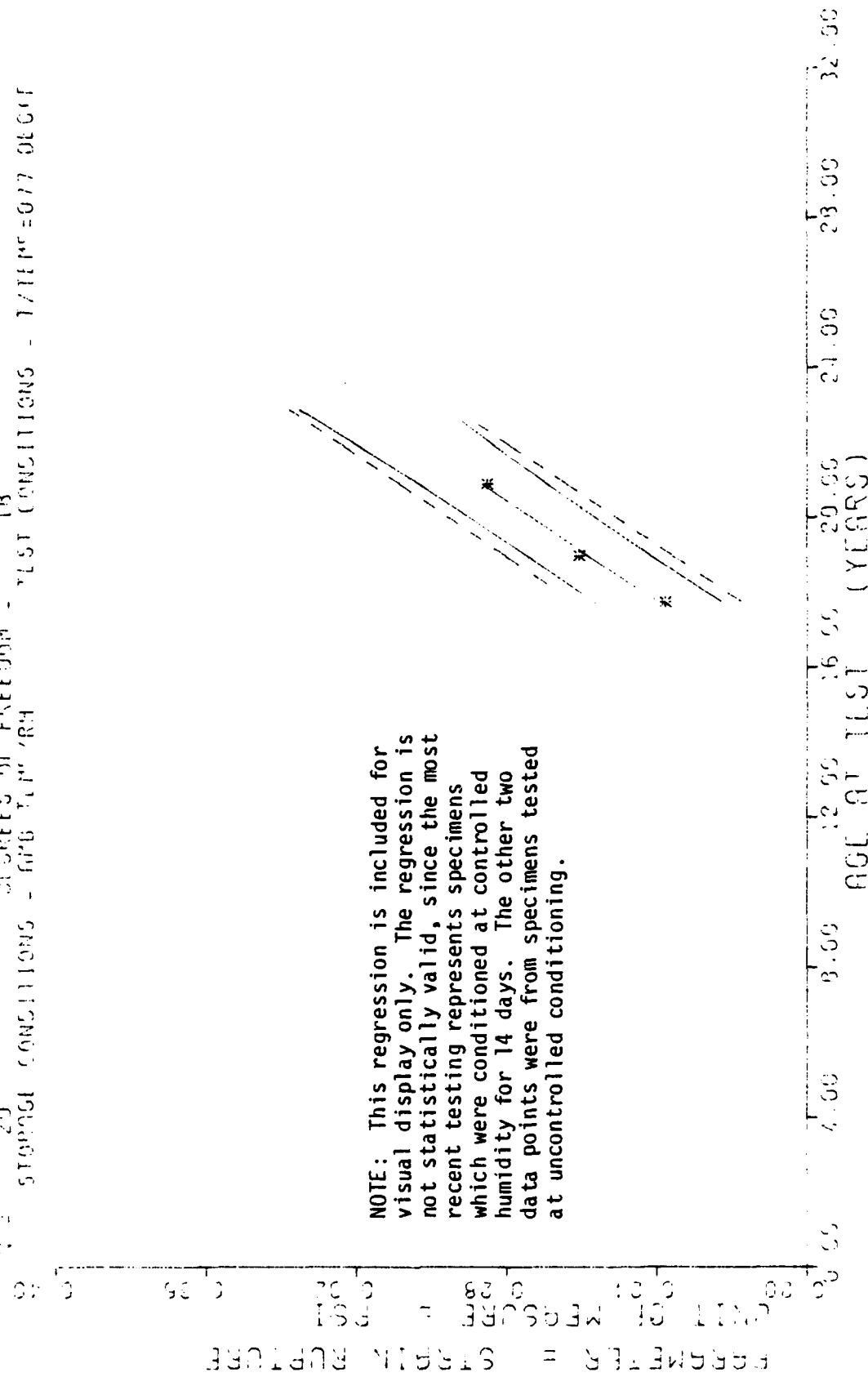


II STAGE DSCT MTR, BI-PROP, CHS=.0002 IN/MIN, T/TEMP=077DEG(F), MAX STRES

Figure 16-B



Y = 11 2 1833536E-02 J = 1 1 2382707E-03 J \* X)  
 F = 11 2210336E-02 SIGNIFICANCE OF F = SIGNIFICANT S<sub>1</sub> = +2 9941793E-02  
 R = 11 335503E-03 SIGNIFICANCE OF R = SIGNIFICANT S<sub>2</sub> = +1 1115273E-04  
 T = 11 1050202E-01 SIGNIFICANCE OF T = SIGNIFICANT S<sub>3</sub> = +7 3904107E-03  
 D = 29 DEGREES OF FREEDOM = 18  
 STORAGE CONDITIONS = 60% HUMIDITY TEST CONDITIONS = 77% HUMIDITY



11 51891 9501 MTR. 61-PROP (HS-0052 1/TEMP=0770E01) STN RUP<0022687>

Figure 17

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+2.3783302E-01	+9.8937423E-03	+2.5099998E-01	+2.2799998E-01	+2.3972803E-01
228.0	8	+2.6049971E-01	+6.4245220E-03	+2.7099996E-01	+2.5099998E-01	+2.5815212E-01
251.0	6	+2.8516638E-01	+6.6851655E-03	+2.9099994E-01	+2.7399998E-01	+2.8640234E-01

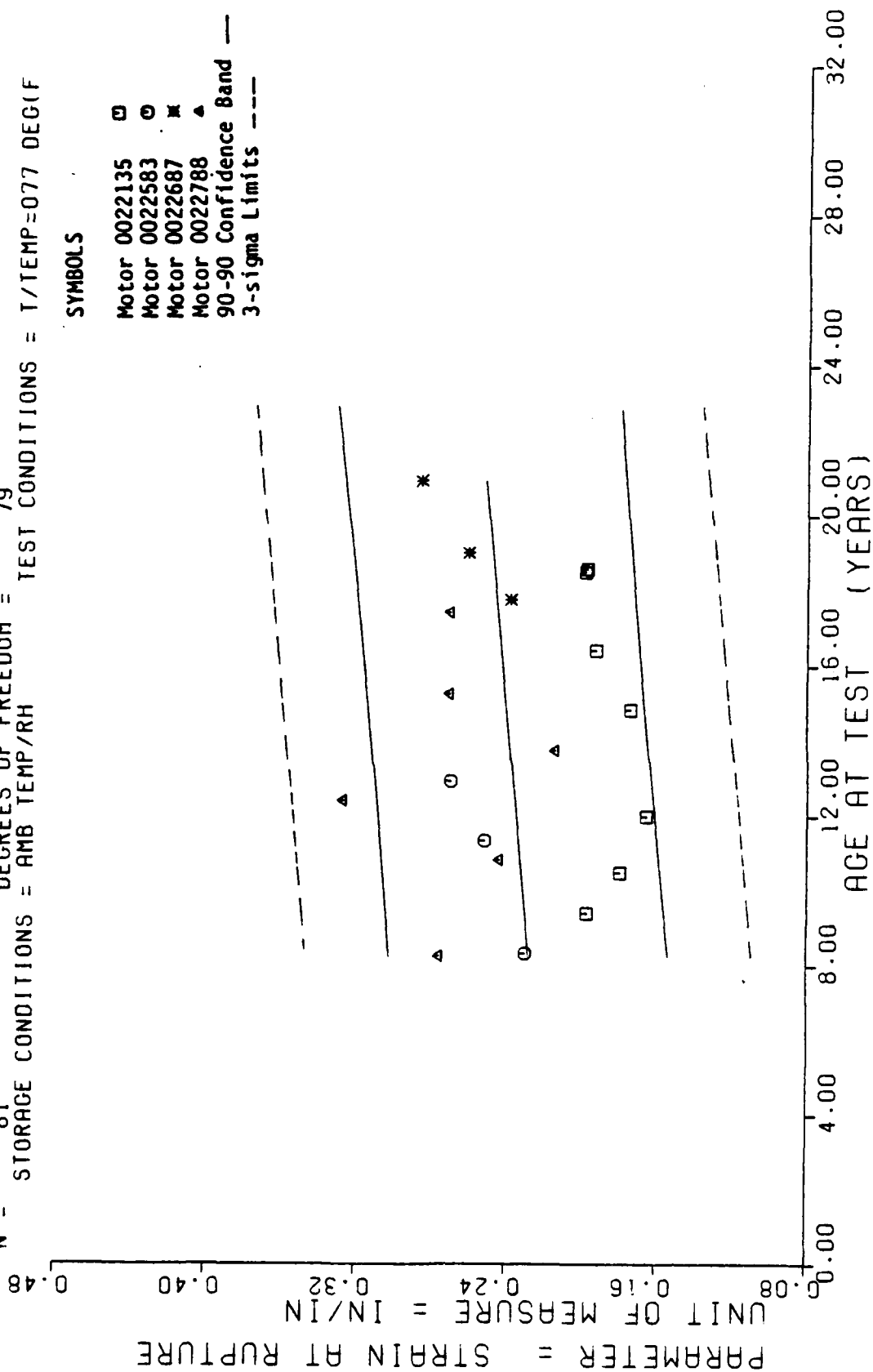
II STAGE LSCT MTR.

BI-FRCP,CHS=.0002,1/TEMP=0770EG(F),STN RUF<0022687>

$Y = ((+2.1254117E-01) + (+1.5374973E-04) * X)$   
 F = +3.4309256E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 R = +2.0401428E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 t = +1.8522758E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT  
 N = 81 DEGREES OF FREEDOM = 79  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = T/TEMP=077 DEG(F)

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



II STAGE DSCT MR, BI-PROP, CHS=.0002 IN/MIN, T/TEMP=077 DEG(F), STRN/RUP

Figure 17-B

[illegible]

1783-1793 = A 16 + 1780, 1791.

THE UNIVERSITY OF CHICAGO

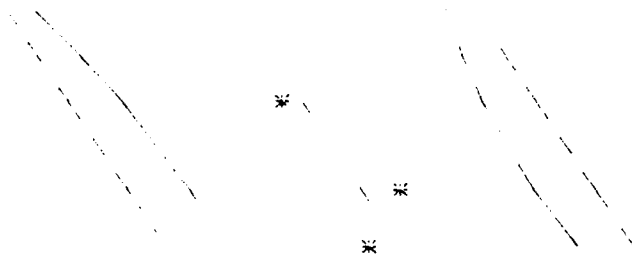
# THE HISTORY OF THE UNITED STATES

**REPORT OF THE**

1171 - 50111500 - 1711

UNIT OF MEASURE - PSL

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represented specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.



AGE	AT	TEST	(YLGFS)	T	T	T	T
12.96	16.96	20.96	24.96	28.96	32.96		

II ST651 5501 37R  
- 61-PR9P CHS=0002 Y/YLPT=0770(61F) MSGULJ5<0922697>

Figure 18

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	0	+2.3216665E+02	+6.7940057E+00	+2.3900000E+02	+2.2300000E+02	+2.2875692E+02
228.0	4	+2.2875000E+02	+1.0031808E+01	+2.4200000E+02	+2.1000000E+02	+2.3297508E+02
251.0	6	+2.4166665E+02	+4.7609522E+00	+2.4300000E+02	+2.3600000E+02	+2.3944293E+02

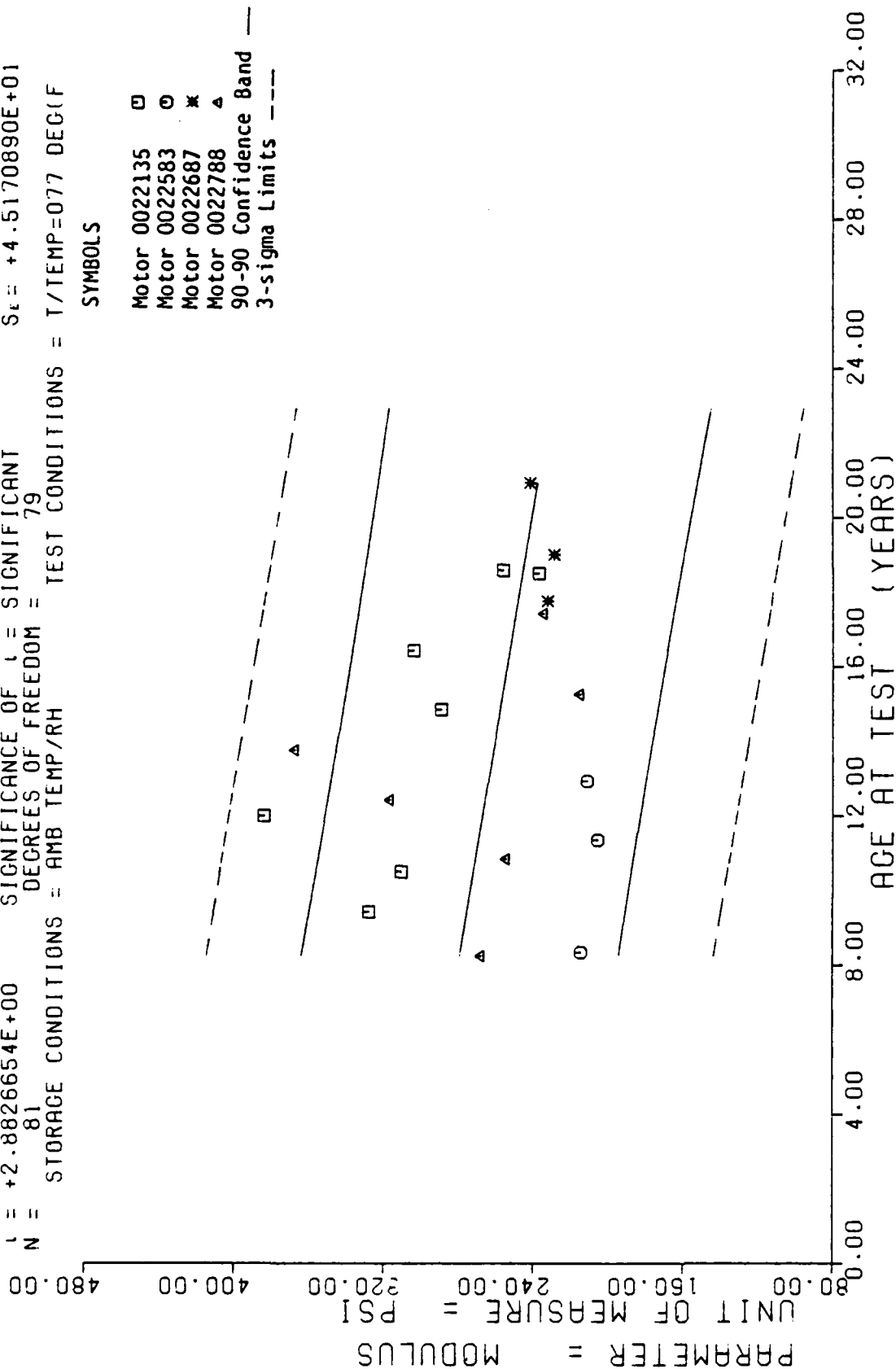
II STAGL USCT MTR.

BI-PROP,CHS=.0002,1/TEMP=077DEG(F),MODULUS<0022687>

$Y = ((+3.0620985E+02) + (-2.7320822E-01) * X)$   
 F = +8.3097600E+00 SIGNIFICANCE OF F = SIGNIFICANT  
 R = -3.0850545E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 L = +2.8826654E+00 SIGNIFICANCE OF L = SIGNIFICANT  
 N = 81 DEGREES OF FREEDOM = 79  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = T/TEMP=077 DEG(F)

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ---

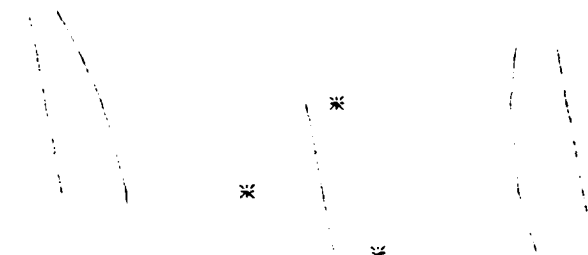


II STAGE DSCT MTR. BI-PROP, CHS=.0002 IN/MIN, T/TEMP=077 DEG(F), MODULUS

Figure 18-B

F = +3 356133E-01 SIGNIFICANCE OF F = +3 163125E-02 ) A R)  
 R = +1 307806E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 T = +5 686245E-01 SIGNIFICANCE OF T = NOT SIGNIFICANT  
 S = +3 776440E-02 SIGNIFICANCE OF S = NOT SIGNIFICANT  
 DEGREES OF FREEDOM = 15  
 STORAGE CONDITIONS - 6PB 11P5 RH TEST CONDITIONS - 6PB 11P5 RH

PERMETER = MAXIMUM STRESS  
 UNIT OF MEASURE = PSI  
 128.00 120.00 112.00 104.00 96.00 88.00 80.00 72.00 64.00 56.00 48.00 40.00 32.00



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

AGE AT TEST (YEARS)  
 0.00 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00

11 STAGE TEST MTRG ONLY, OUTER AXIAL FOS DIAXIAL (HS-0 2 MAX STRESS <0922607>

Figure 19

\*\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	6	+1.0433157E+02	+3.5768483E+00	+1.0858999E+02	+1.0026998E+02	+1.0625286E+02
228.0	6	+1.1001663E+02	+3.0872500E+00	+1.1398999E+02	+1.0575999E+02	+1.0675895E+02
251.0	6	+1.0614990E+02	+2.0094474E+00	+1.0909999E+02	+1.0340998E+02	+1.0748648E+02

II STAGE DSCT MTRS ONLY. OUTER. AXIAL POS. BIAxIAL CHS=0.2 MAX STRESS <0022687>

Figure 19-A



Y = 11 +1 0000237E+02 J = 1 -2 1231961E+03 J K X)  
 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 DEGREES OF FREEDOM = 30  
 STORAGE CONDITIONS - 678 HRS /RH TEST CONDITIONS - 678 HRS /RH

# SYMBOLS

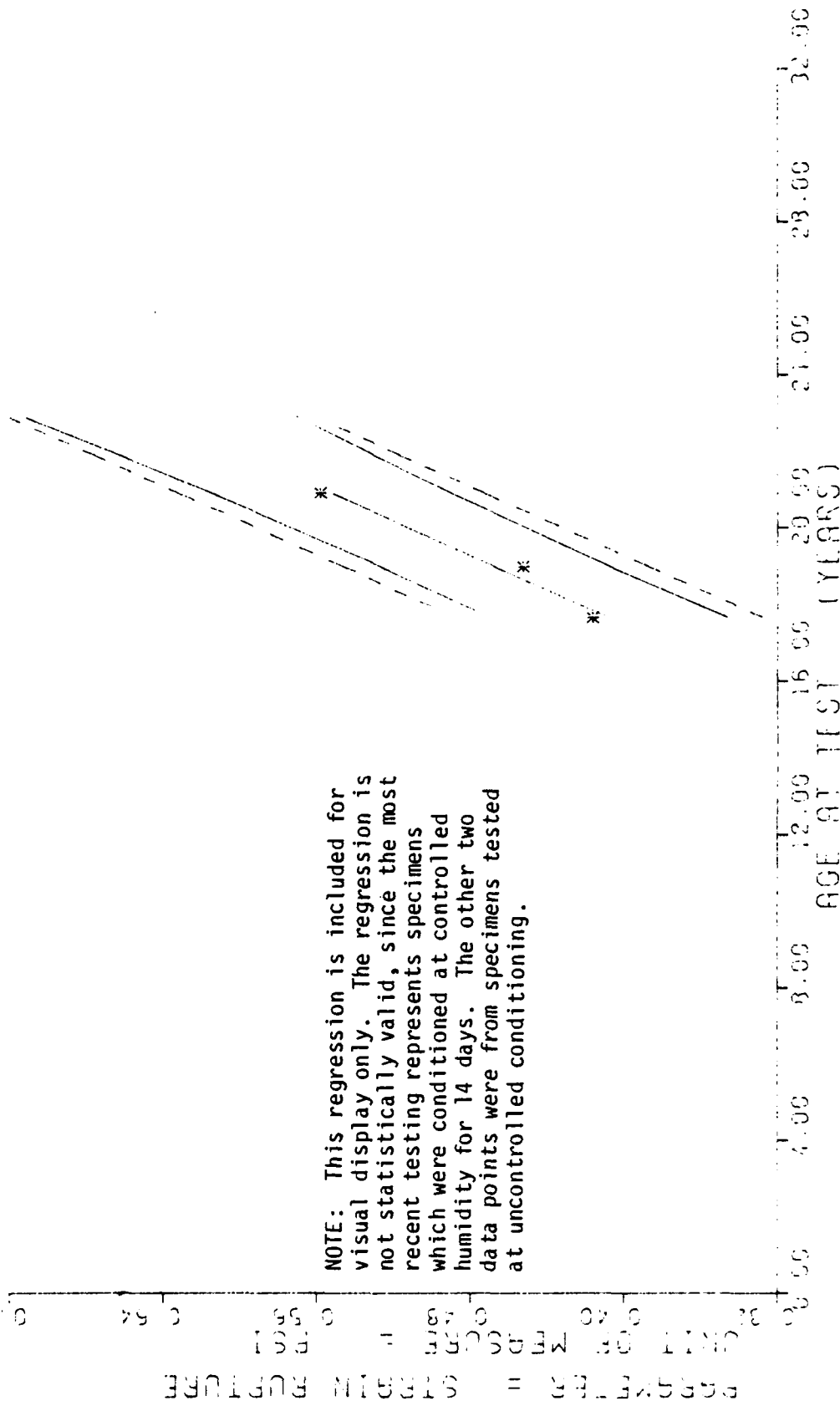
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 ✖  
 Motor 0022788 ▲  
 90-90 Confidence Band —  
 3-sigma Limits ----

PARAMETER = MAXIMUM STRESS  
 UNIT OF MEASURE = PSI  
 160 00 180 00 200 00 220 00 240 00 260 00 280 00 300 00 320 00 340 00 360 00 380 00 400 00 420 00 440 00 460 00 480 00 500 00 520 00 540 00 560 00 580 00 600 00 620 00 640 00 660 00 680 00 700 00 720 00 740 00 760 00 780 00 800 00 820 00 840 00 860 00 880 00 900 00 920 00 940 00 960 00 980 00 1000 00

11 STAGE 0501 HRS ONLY, AXIAL PSS MAXIAL CHS-0 2 IN/MIN, MAXIMUM STRESS  
 AGE AT TEST (YEARS)

Figure 19-B

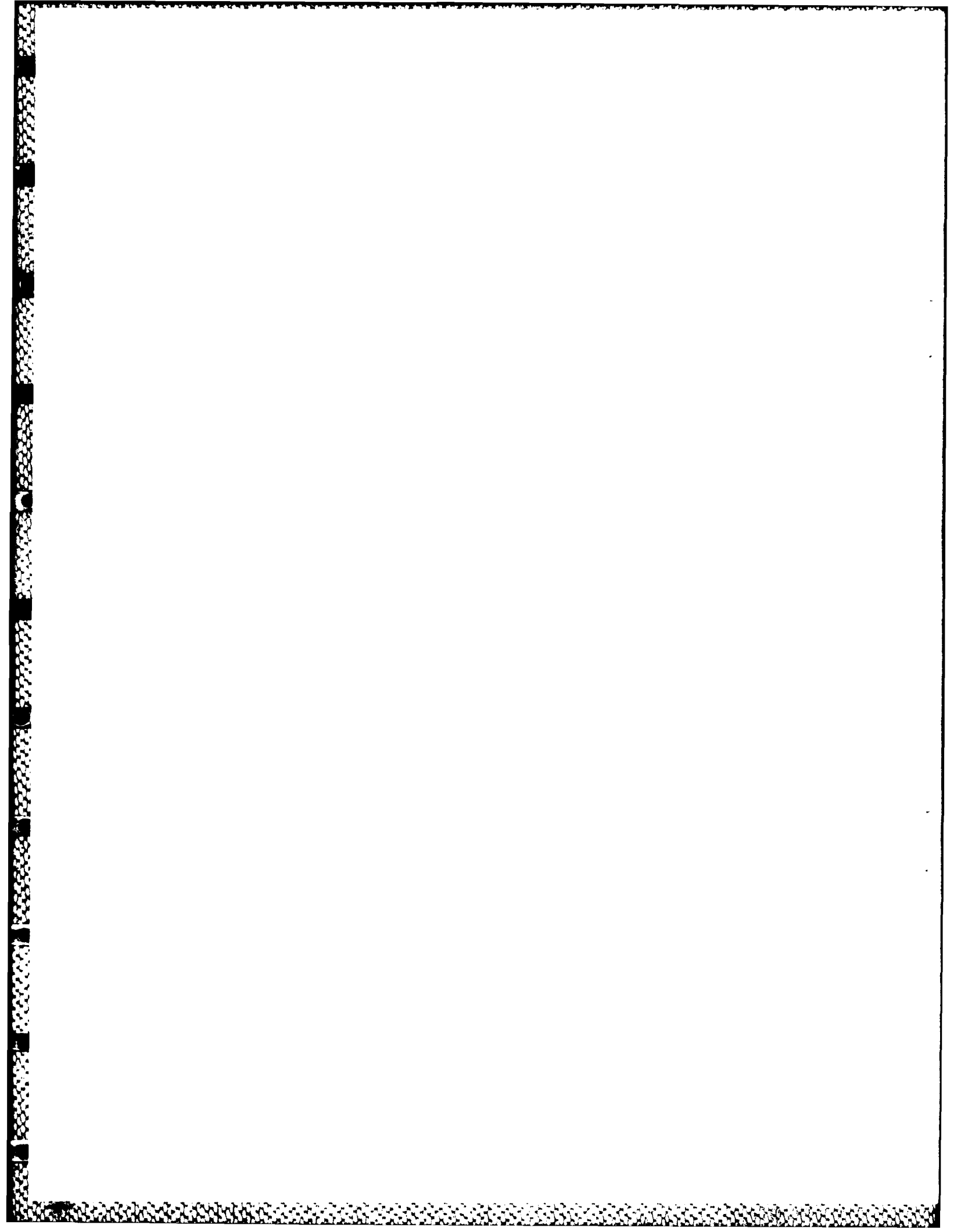
$Y = 0.00137734193E-01$   $X = 0.037052471E-03$   $X^2 = 0.00137734193E-01$   
 $F = +0.00254376E-01$  SIGNIFICANCE OF F = SIGNIFICANT  $S.E. = +6.6217533E-02$   
 $R = +0.2164542E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S.E. = +3.8999495E-04$   
 $T = +0.500756E-05$  SIGNIFICANCE OF T = SIGNIFICANT  $S.E. = +2.6485223E-02$   
 $D.F. = 18$  DEGREES OF FREEDOM = 18  
 $H = 0.00000000E+00$  STORAGE CONDITIONS = 6PB PLP/CRH  
 $Y = 0.00137734193E-01$   $X = 0.037052471E-03$   $X^2 = 0.00137734193E-01$   
 $F = +0.00254376E-01$  SIGNIFICANCE OF F = SIGNIFICANT  $S.E. = +6.6217533E-02$   
 $R = +0.2164542E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S.E. = +3.8999495E-04$   
 $T = +0.500756E-05$  SIGNIFICANCE OF T = SIGNIFICANT  $S.E. = +2.6485223E-02$   
 $D.F. = 18$  DEGREES OF FREEDOM = 18  
 $H = 0.00000000E+00$  STORAGE CONDITIONS = 6PB PLP/CRH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

11 STAGE 03CT MRS ONLY, OUTLIER, AXIAL FOS MAXIAL CHS-0 2 SIN RUPTUR <09222687>

Figure 20



\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

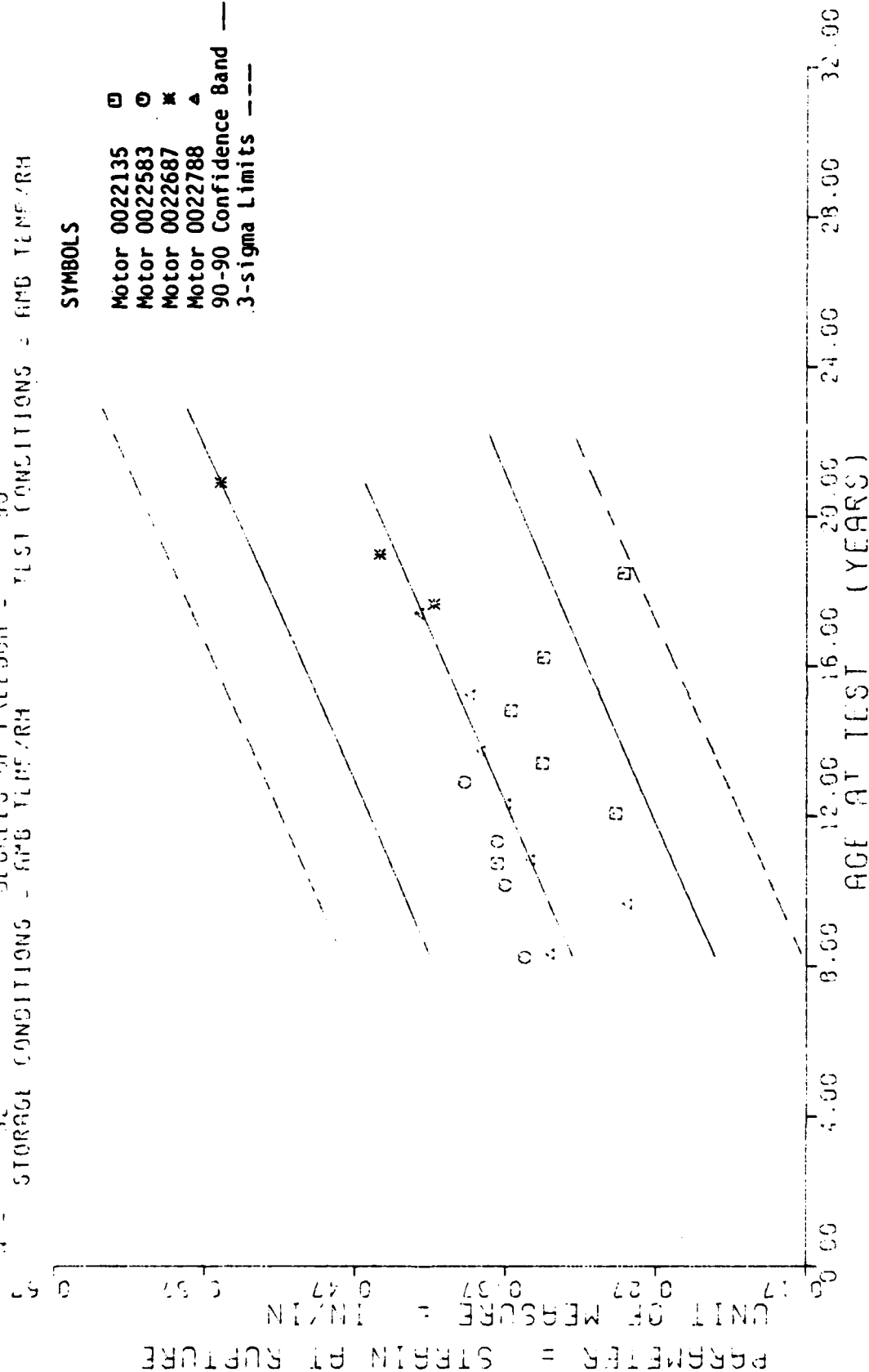
\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	6	+4.1618299E-01	+2.5147934E-02	+4.4879596E-01	+3.8239997E-01	+4.0757042E-01
228.0	6	+4.5224964E-01	+2.6090483E-02	+4.8189597E-01	+4.1409999E-01	+4.6685439E-01
251.0	6	+5.5806636E-01	+2.3319520E-02	+5.8189994E-01	+5.2289998E-01	+5.5207508E-01

II STAGE DSCT MTRS ONLY, OUTER, AXIAL POS. BIAxIAL CHS=0.2 STN RUPTUR <0022687>

Y = 11 + 2 3321435E-01 J + 19 9873504E-04 J \* X  
 F = +6 8201071E-01 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +6 5683117E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +8 2639412E+00 SIGNIFICANCE OF T = SIGNIFICANT  
 D = 12 DEGREES OF FREEDOM = 30  
 STORAGE CONDITIONS - RMS TEMP/RH TEST CONDITIONS - RMS TEMP/RH

SYMBOLS  
 Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



II STAGE TEST MTRG ONLY, OUTER AXIAL POS BIAXIAL CHS-0 2 IN/MIN. STRAIN/RUPTURE

Figure 20-B

$Y = (1 + 2.1904178E-03) X^2 - 6.7456634E+00 + 1.3964408E+02$   
 F = +2.7603016E-01 SIGNIFICANCE OF F = SIGNIFICANT  $S_e = +1.3964408E+02$   
 R = +7.0565045E-01 SIGNIFICANCE OF R = SIGNIFICANT  $S_e = +1.2839263E+00$   
 T = +5.2539334E+00 SIGNIFICANCE OF T = SIGNIFICANT  $S_e = +8.7193629E-01$   
 DEGREES OF FREEDOM = 15  
 STORAGE CONDITIONS = AMBI TEMP/RH TEST CONDITIONS = AMBI TEMP/RH

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

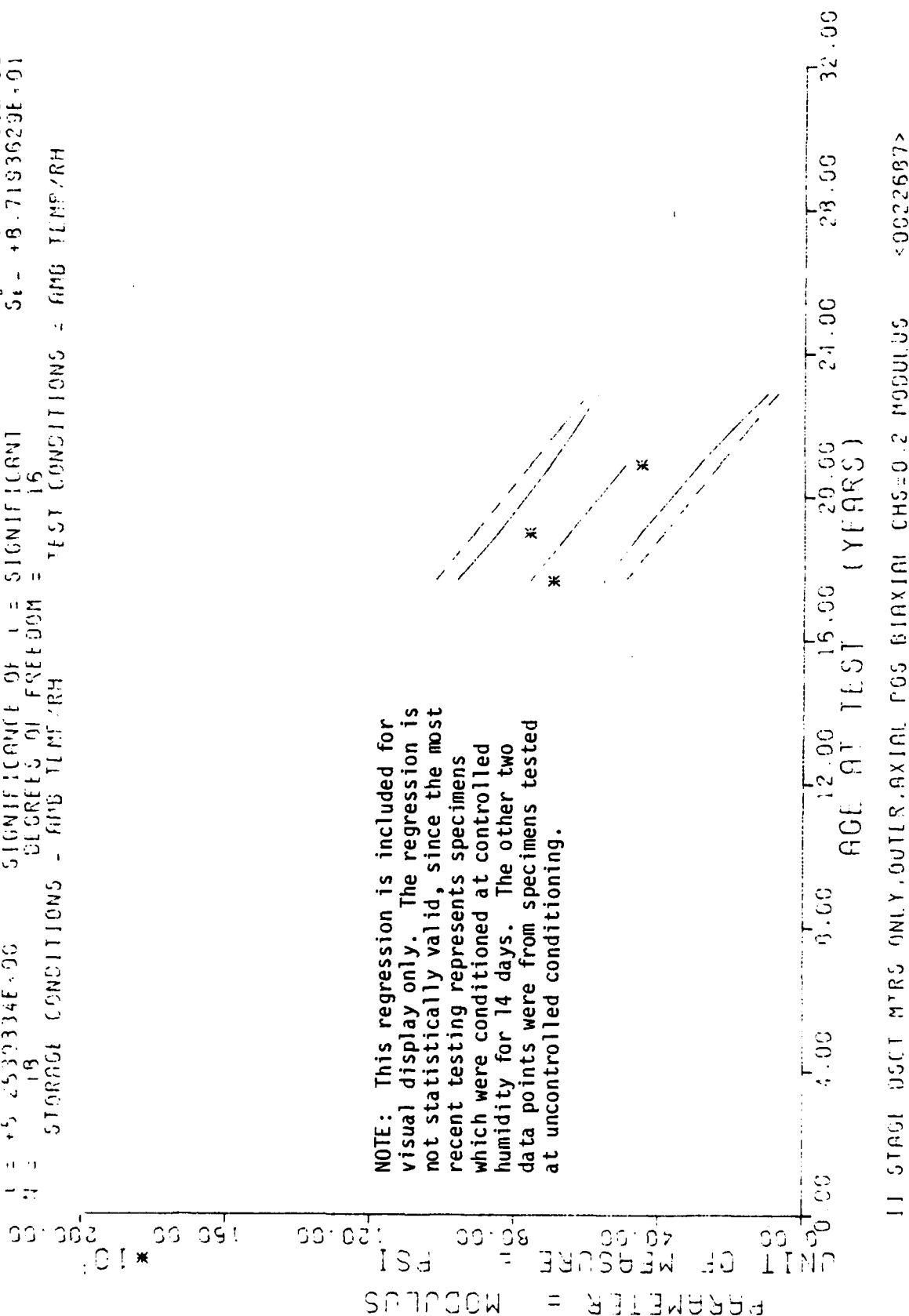


Figure 21

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

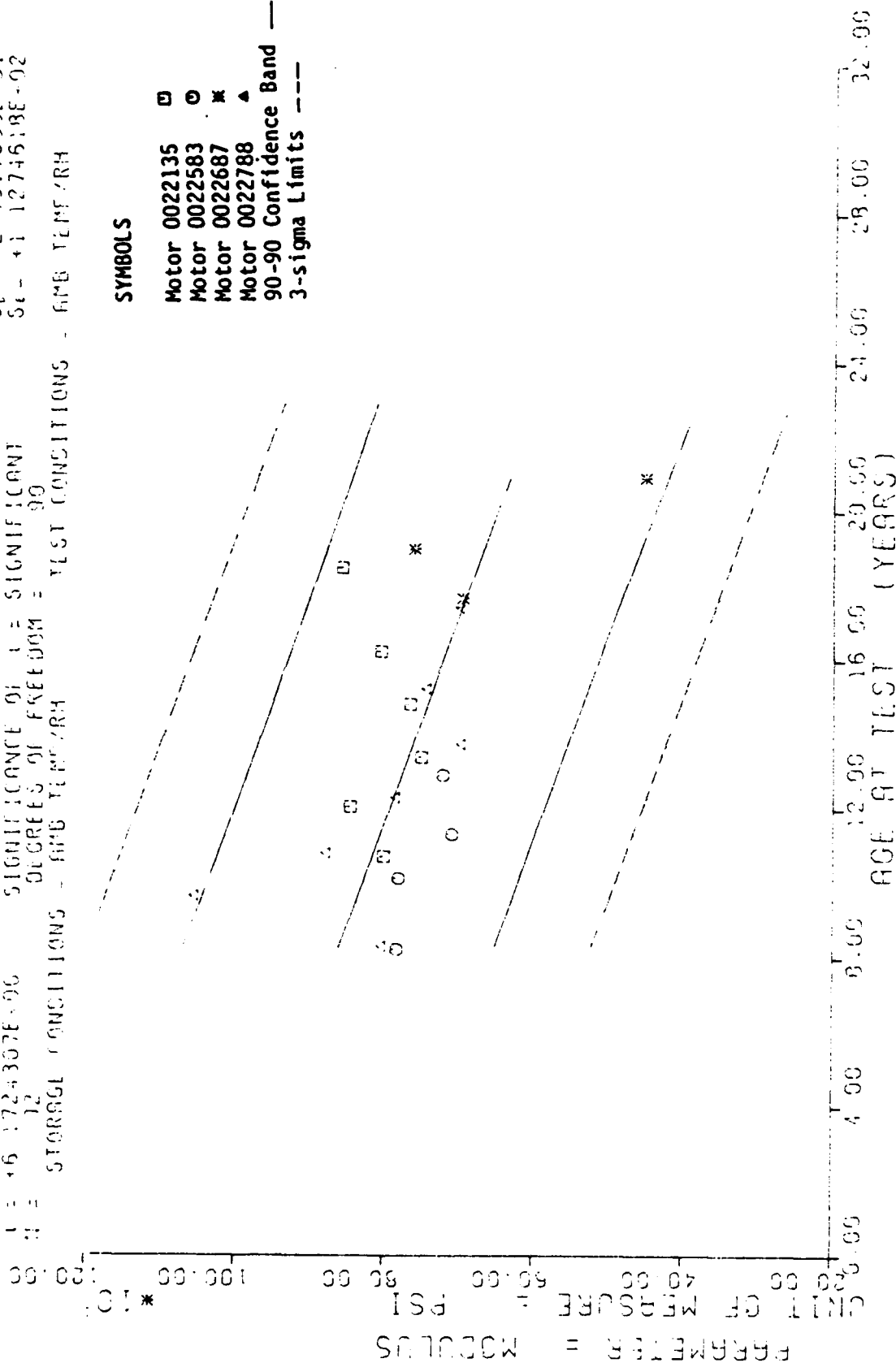
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	6	+6.960000E+02	+4.1689327E+01	+7.4900000E+02	+6.4200000E+02	+7.6033715E+02
228.0	6	+7.6150000E+02	+2.5680732E+01	+7.8800000E+02	+7.1500000E+02	+6.5240649E+02
251.0	6	+4.5250000E+02	+1.6694310E+01	+4.6800000E+02	+4.2900000E+02	+4.9725610E+02

II STAGE DSCT MTRS ONLY, OUTER, AXIAL POS. BIAxIAL CHS=0.2 MODULUS <0022687>

F = +3 4099991E-01 SIGNIFICANCE OF F = 1 5010055E-06 F = X)  
 R = +5 4536630E-01 SIGNIFICANCE OF R = 1 5010055E-06 F = X)  
 T = +6 1724307E-06 SIGNIFICANCE OF T = 1 5010055E-06 F = X)  
 D = 12 DEGREES OF FREEDOM = 99  
 STORAGE CONDITIONS - 6MB TEMP/RH TEST CONDITIONS - 6MB TEMP/RH

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band —  
 3-sigma Limits ----



11 STAGE 050T MRS ONLY,OUTER,AXIAL PSS DIA/IN CHS-0 2 IN/MIN. MODULUS

Figure 21-B

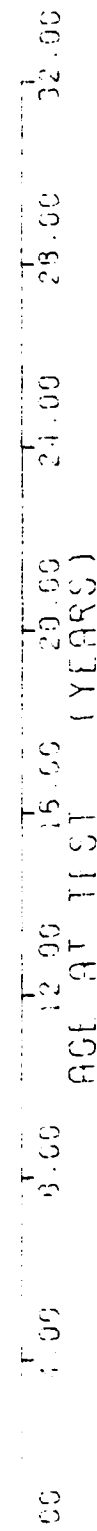


Y = +1 +1 2694355E+02 J = -4 2931483E+02 J = X  
 F = +9 5856247E+02 SIGNIFICANCE OF F = NOT SIGNIFICANT G = +9 1159688E+00  
 R = 7 756999E+02 SIGNIFICANCE OF R = NOT SIGNIFICANT S = +1 3794694E+01  
 T = +3 1121736E+01 SIGNIFICANCE OF T = NOT SIGNIFICANT S = +9 3682122E+00  
 N = 18 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMBI TEMPERH TEST CONDITIONS = AMBI TEMPERH

PARAMETER = MAXIMUM STRESS

UNIT OF MEASURE = PSI

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.



11 STAGE TEST MPTS ONLY INNER AXIAL FOR MAXIAL CHS-0 2 MAX STRESS 0022687>

Figure 22

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	6	+1.1812158E+02	+9.0041784E+00	+1.3273999E+02	+1.0825000E+02	+1.1694206E+02
228.0	6	+1.1425495E+02	+1.1017208E+00	+1.1536999E+02	+1.1277999E+02	+1.1625517E+02
251.0	6	+1.1608821E+02	+1.3831803E+01	+1.2755999E+02	+9.1019989E+01	+1.1526774E+02

II STAGE DSCT MTRS ONLY INNER, AXIAL POS. BIAxIAL CHS=0.2 MAX STRESS <0022687>

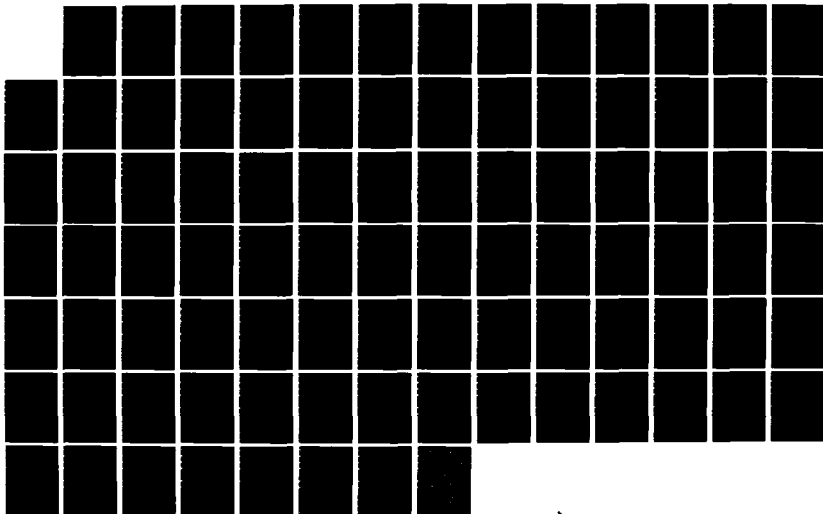
AD-A166 583

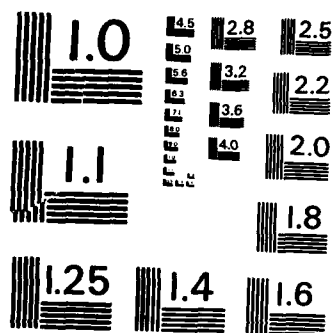
LGM-30B STAGE II DISSECTED MOTOR TEST REPORT(U) OGDEN  
AIR LOGISTICS CENTER HILL AFB UT PROPELLANT ANALYSIS  
LAB E M DALABA JAN 86 MAQCP-514(86)

2/2

UNCLASSIFIED

F/G 21/9.2 NL



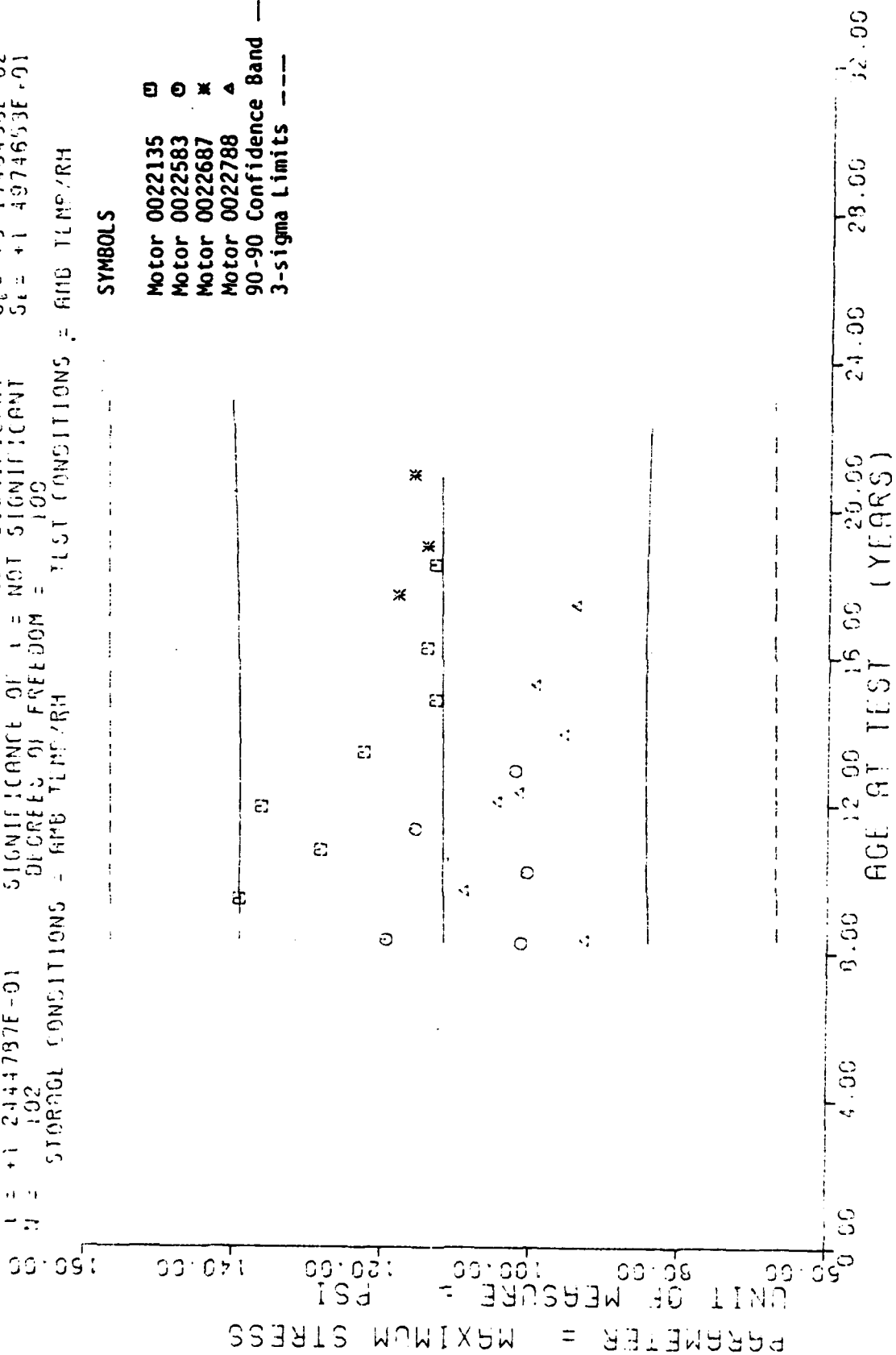


MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

Y = (1 +1) 1133849E+02 ) ( +3.9510320E-03 ) A. X)  
 F = +1 5487274E-02 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 R = +1 2443824E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 T = +1 2444787E-01 SIGNIFICANCE OF T = NOT SIGNIFICANT  
 W = 102 DEGREES OF FREEDOM = 100  
 STORAGE CONDITIONS = 4MB TENS/RH TEST CONDITIONS = 4MB TENS/RH

**SYMBOLS**

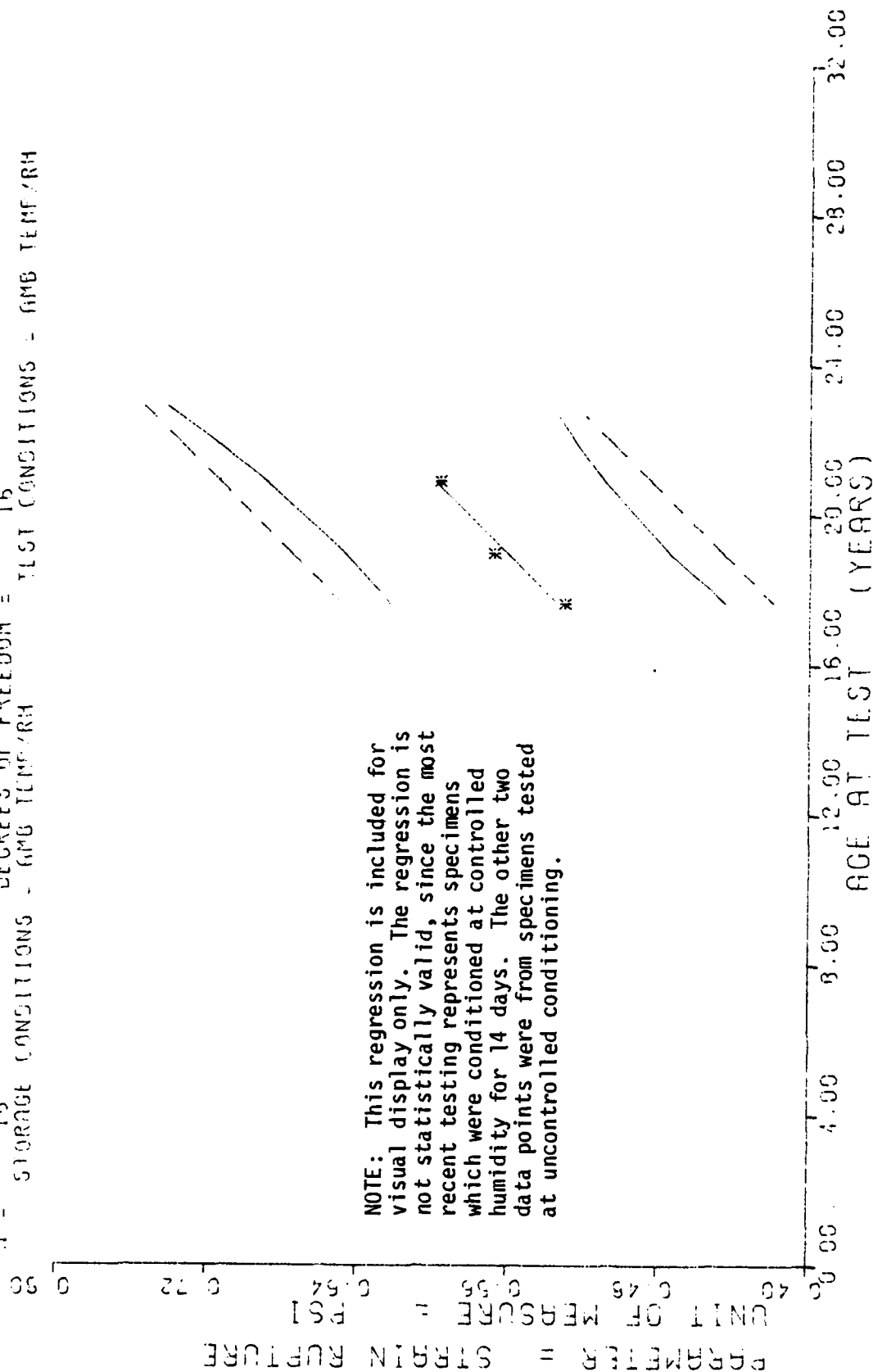
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band —  
 3-sigma Limits ----



STAGE 11 DISSECTED MTR. INNER AXIAL POS BIAXIAL CHS=0 2 IN/MIN. MAX STRESS

Figure 22-B

$Y = 11 + 1.7774491E-01 X + 1.6746964E-03 X^2$   
 F = +8.9254899E+99 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +5.9623914E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +2.9707724E+99 SIGNIFICANCE OF T = SIGNIFICANT  
 D.F. = 18 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = 6MB TEMP/RH TEST CONDITIONS = 6MB TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represented specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

11 STAGE 05CT MTRS ONLY, INNER AXIAL POS BIAXIAL CH5-0 2 SIN RUPTUR <0022587>

Figure 23

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

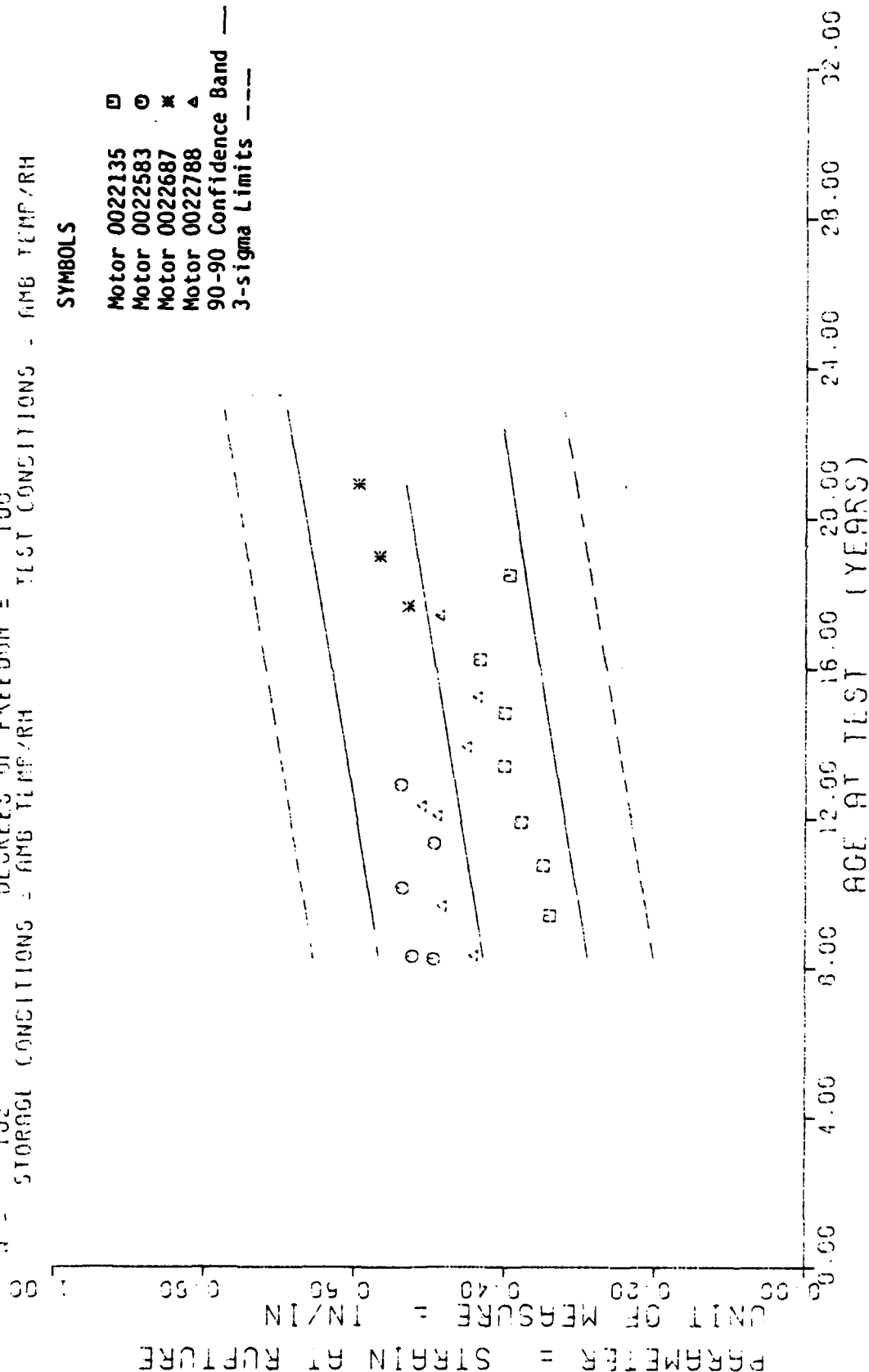
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	6	+5.2871620E-01	+4.0176787E-02	+5.8889997E-01	+4.7499996E-01	+5.3278052E-01
228.0	6	+5.6646615E-01	+3.7288596E-02	+6.1599999E-01	+5.0499999E-01	+5.5957567E-01
251.0	6	+5.9526634E-01	+3.9995651E-02	+6.3709998E-01	+5.1999998E-01	+5.9809368E-01

II STAGE DSCT NTRS ONLY. INNER, AXIAL POS. BIAxIAL CHS=0.2 STN RUPTUR <0022687>

F = +1 8294316E-01  
 R = +3 9326217E-01  
 T = +4 2772557E-06  
 N = 102  
 STORAGE CONDITIONS = AMB TEMP/RH  
 Y = (1 +3 6041984E-01) \* ( +5 8426557E-04 ) \* X  
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF R = SIGNIFICANT  
 SIGNIFICANCE OF T = SIGNIFICANT  
 DEGREES OF FREEDOM = 100  
 TEST CONDITIONS = AMB TEMP/RH

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----

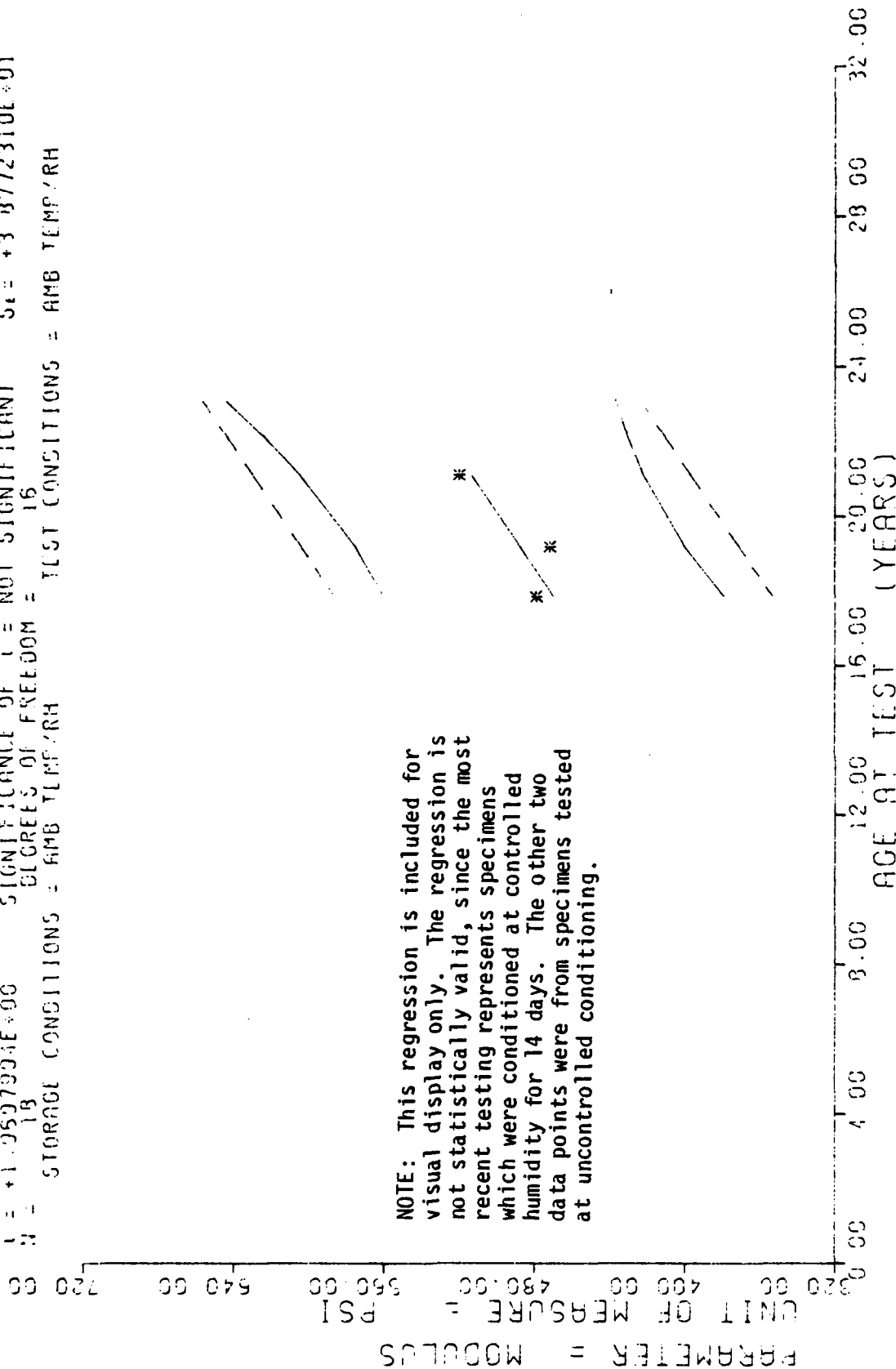


II STAGE TEST MRS. INNER AXIAL POS. BIAXIAL CHS=0 2 IN/MIN. STRAIN AT RUPTURE

Figure 23-B



Y = (1 +2.2968878E+02 ) + ( +1 1246024E+00 ) \* X1  
 F = +3 9561007E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT G1 = +4 1928237E+01  
 R = +4 4178658E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S1 = +5 7092233E-01  
 U = +1 0597904E+00 SIGNIFICANCE OF U = NOT SIGNIFICANT S2 = +3 8772310E+01  
 W = 18 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

11 STAGE TEST MIRS ONLY, INNER, AXIAL POS BIAXIAL CHS=0 2 MODULUS <0022687>

Figure 24

\*\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

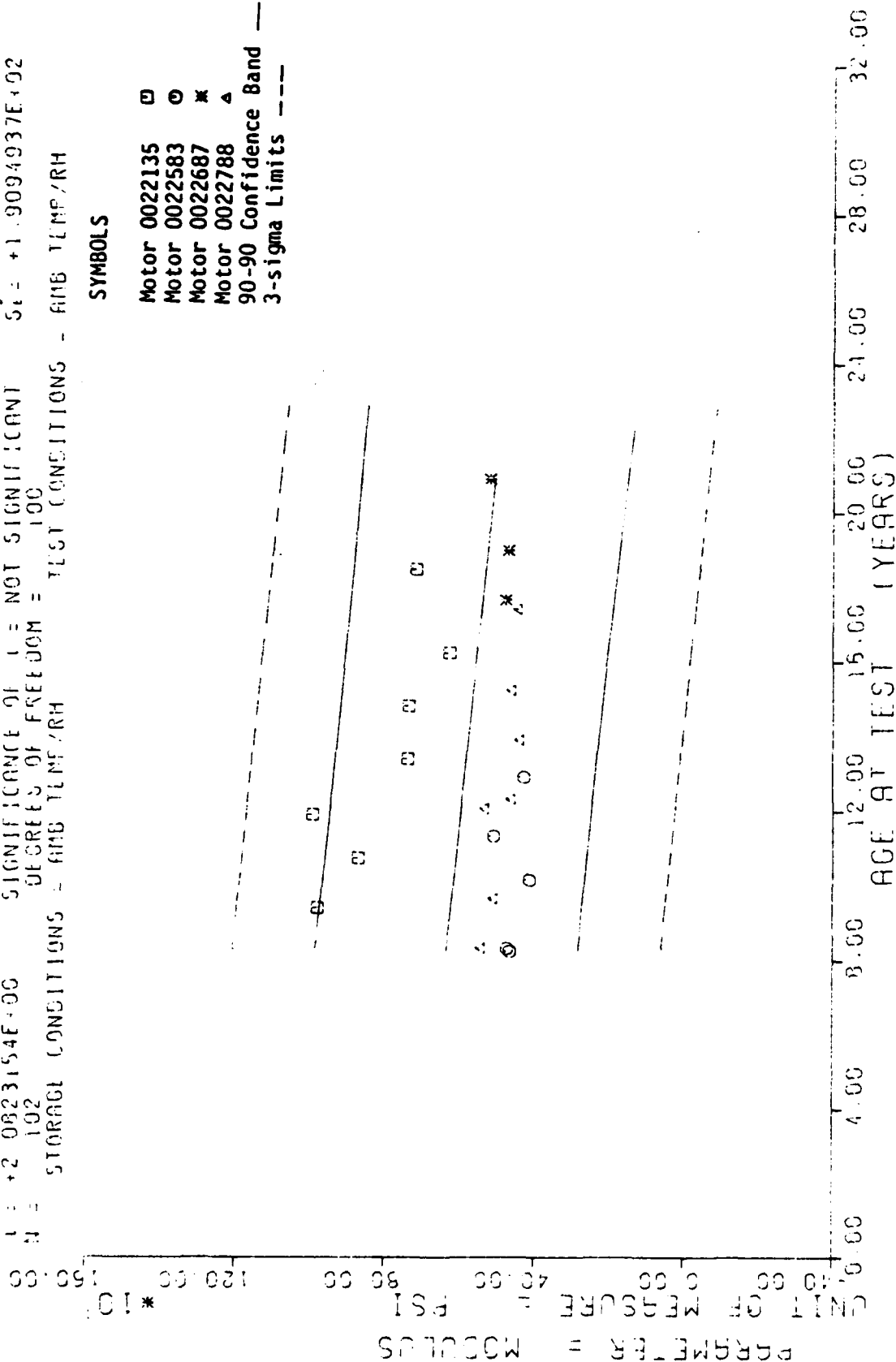
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	6	+4.7750000E+02	+8.3126409E+00	+4.89000000E+02	+4.70000000E+02	+4.6810449E+02
228.0	6	+4.7016650E+02	+1.5689699E+01	+4.83000000E+02	+4.40000000E+02	+4.8609814E+02
251.0	6	+5.1850000E+02	+6.3509841E+01	+6.28000000E+02	+4.65000000E+02	+5.1196386E+02

II STAGE CSCT NTRS ONLY INNER, AXIAL PCS.BIAXIAL CHS=0.2 MODULUS <0022667>

$Y = 11 + 7.1717275E-02 \cdot X + (-8.430669E-01) \cdot X^2$   
 F = +4 3360375E+00 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +2.0345674E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 T = +2.0623154E+00 SIGNIFICANCE OF T = NOT SIGNIFICANT  
 N = 102 DEGREES OF FREEDOM = 100  
 STORAGE CONDITIONS = 600 RPM/RH TEST CONDITIONS = 600 RPM/RH

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



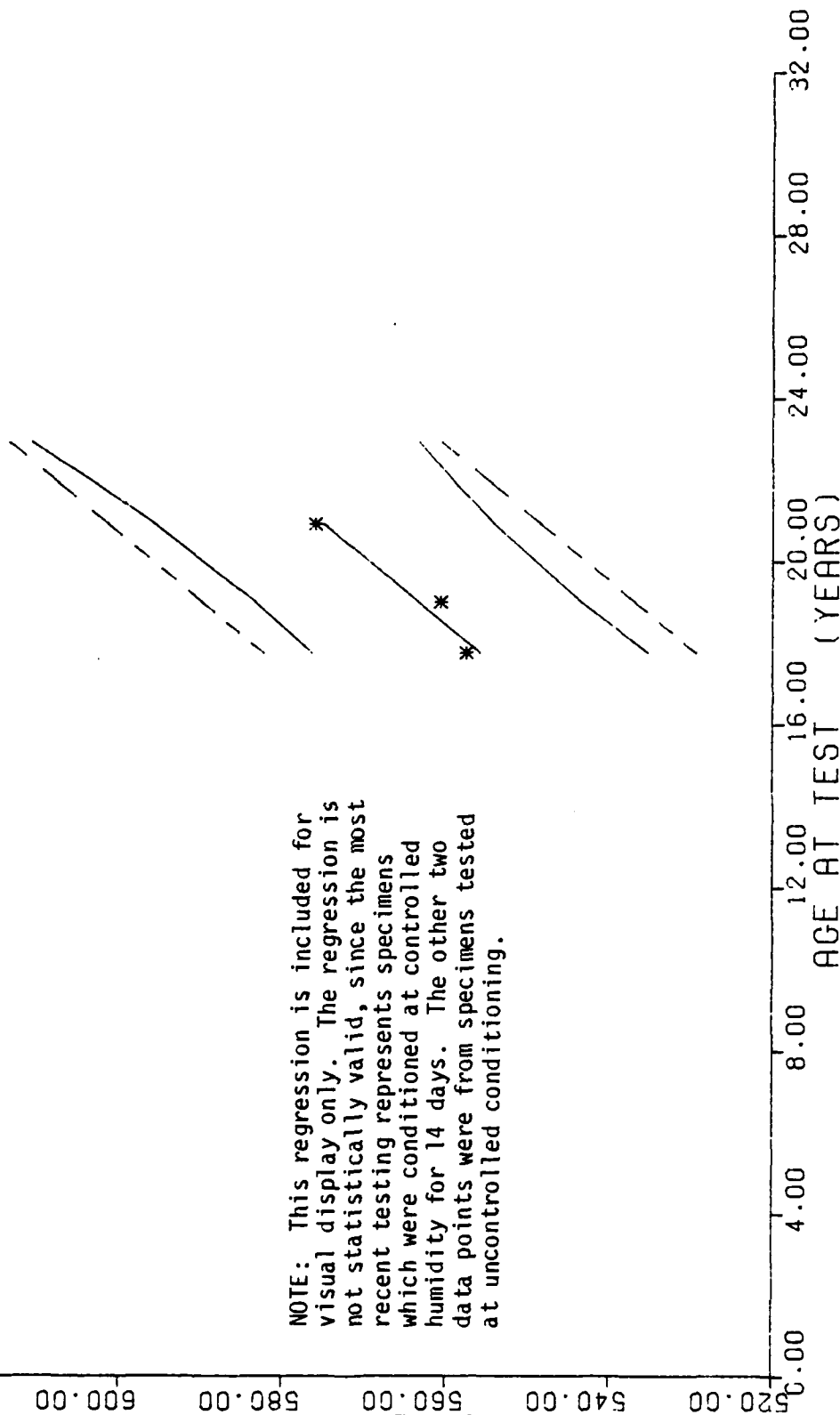
11 STAGE DUCT M'RS. INNER AXIAL POS. BIAXIAL CHS=0 2 IN/MIN. MODULUS

Figure 24-B

$Y = (( +4.4899757E+02 ) + ( +5.0141947E-01 ) * X)$   
 $F = +1.4179701E+01$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = +6.8545045E-01$  SIGNIFICANCE OF R = SIGNIFICANT  
 $t = +3.7655944E+00$  SIGNIFICANCE OF t = SIGNIFICANT  
 $N = 18$  DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

PARAMETER = MAXIMUM STRESS

UNIT OF MEASURE = PSI



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

II STAGE DSCT MTRS.OUTER,AXIAL,H.R.HYDRO.CHS=1750 AT 500 PSI,MAX STR <0022687>

Figure 25

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

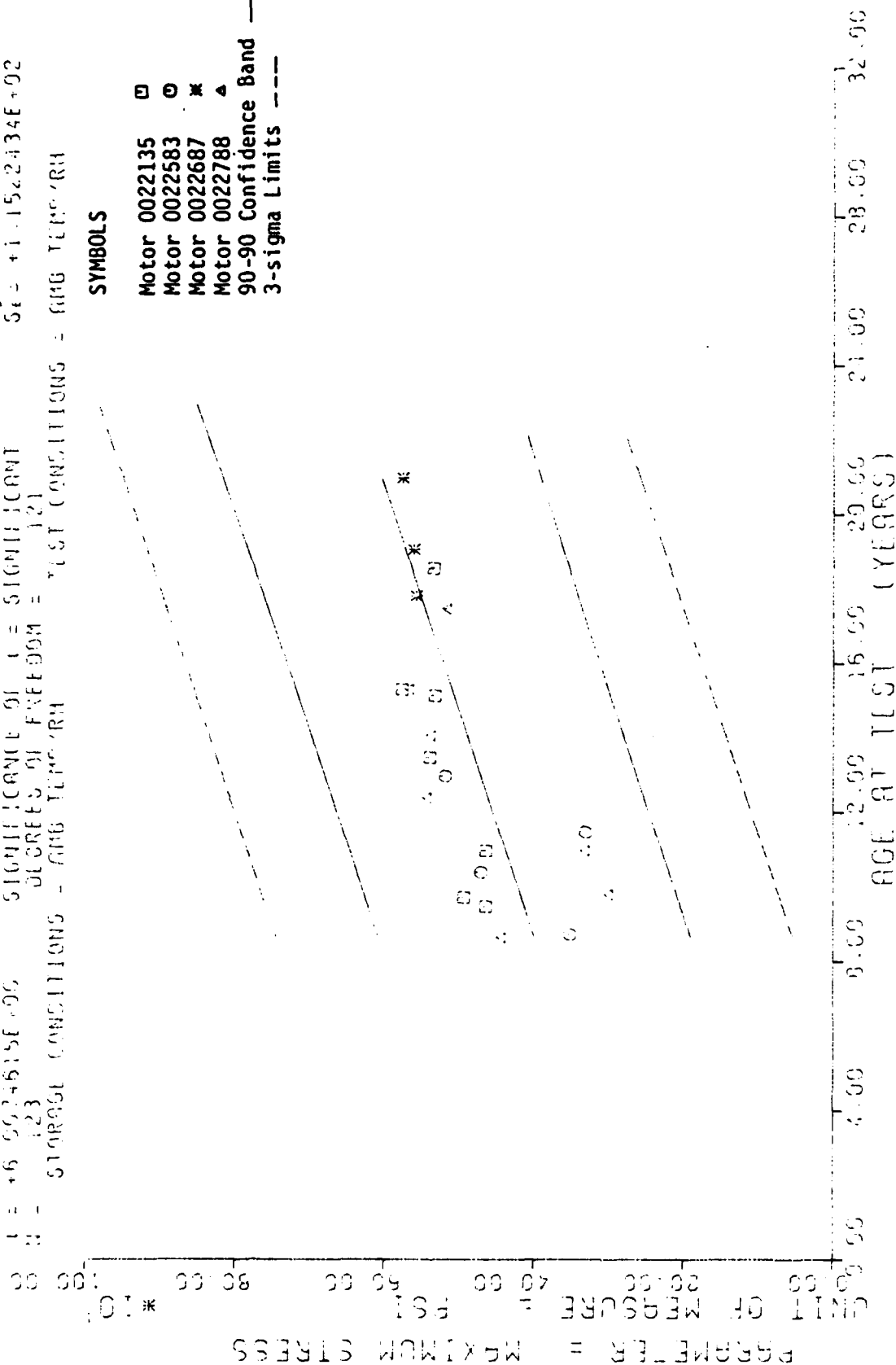
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+5.5744970E+02	+8.7619177E+00	+5.6937588E+02	+5.4351977E+02	+5.5579980E+02
223.0	6	+5.6059472E+02	+4.2242251E+00	+5.6818594E+02	+5.5569995E+02	+5.6332104E+02
251.0	6	+5.7592553E+02	+1.1859873E+01	+5.8400000E+02	+5.5207983E+02	+5.7485375E+02

II STAGE DSCT MTRS.CUTER,AXIAL.H.R.HYDRQ.CHS=1750 AT 500 PSI.MAX STR <0022687>

F = +3 6587504E+01 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +4 7331085E+01 SIGNIFICANCE OF R = SIGNIFICANT  
 U = +6 9934615E+06 SIGNIFICANCE OF U = SIGNIFICANT  
 H = 123 DEGREES OF FREEDOM = 121  
 STORAGE CONDITIONS = AVG TEMPERH  
 TEST CONDITIONS = AVG TEMPERH

# SYMBOLS

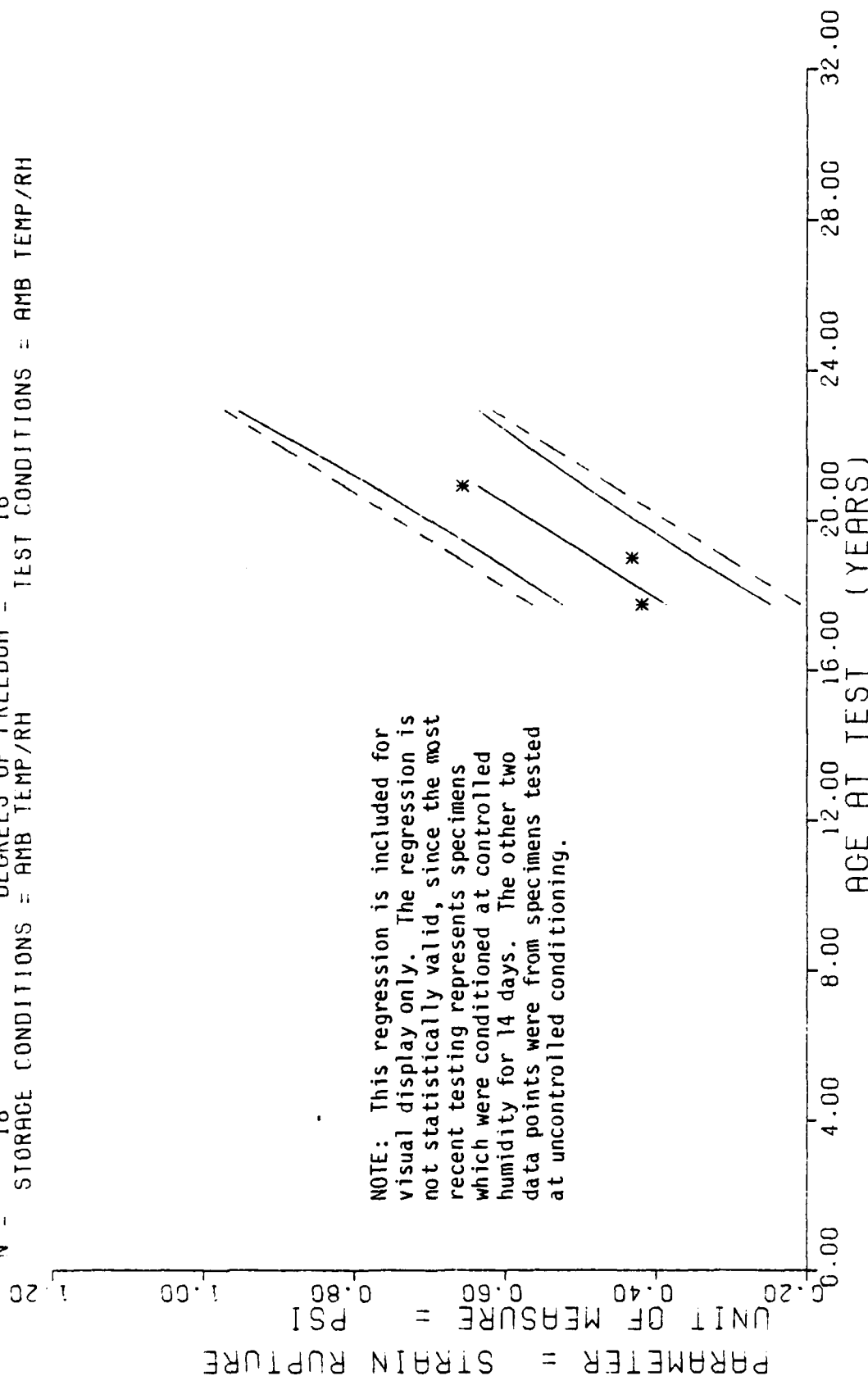
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 ✖  
 Motor 0022788 ▲  
 90-90 Confidence Band —  
 3-sigma Limits ----



11 STAGE 0501 MTR5.001R AXIAL H 8 HYDR9 CHS-1750 AT 500 PSI MAXIMUM STRESS

Figure 25-B

$Y = ((-1.0119684E+00) + (+6.5662647E-03) * X)$   
 F = +5.3994182E+01 SIGNIFICANCE OF F = SIGNIFICANT  $S_F = +1.2022097E-01$   
 R = +8.7829925E-01 SIGNIFICANCE OF R = SIGNIFICANT  $S_R = +8.9360359E-04$   
 t = +7.3480733E+00 SIGNIFICANCE OF t = SIGNIFICANT  $S_t = +5.9248007E-02$   
 N = 18 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

!! STAGE DSCT MTRS. OUTER, AXIAL, H.R. HYDRO. CHS=1750 AT 500 PSI, STN RUP <0022687>

Figure 26

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+4.1884976E-01	+1.4755564E-02	+4.3229597E-01	+3.9659994E-01	+3.8664597E-01
228.0	6	+4.3153292E-01	+2.0334499E-02	+4.6099996E-01	+4.1299998E-01	+4.8513990E-01
251.0	6	+6.5716630E-01	+7.3659002E-02	+7.4299597E-01	+5.2499557E-01	+6.3616400E-01

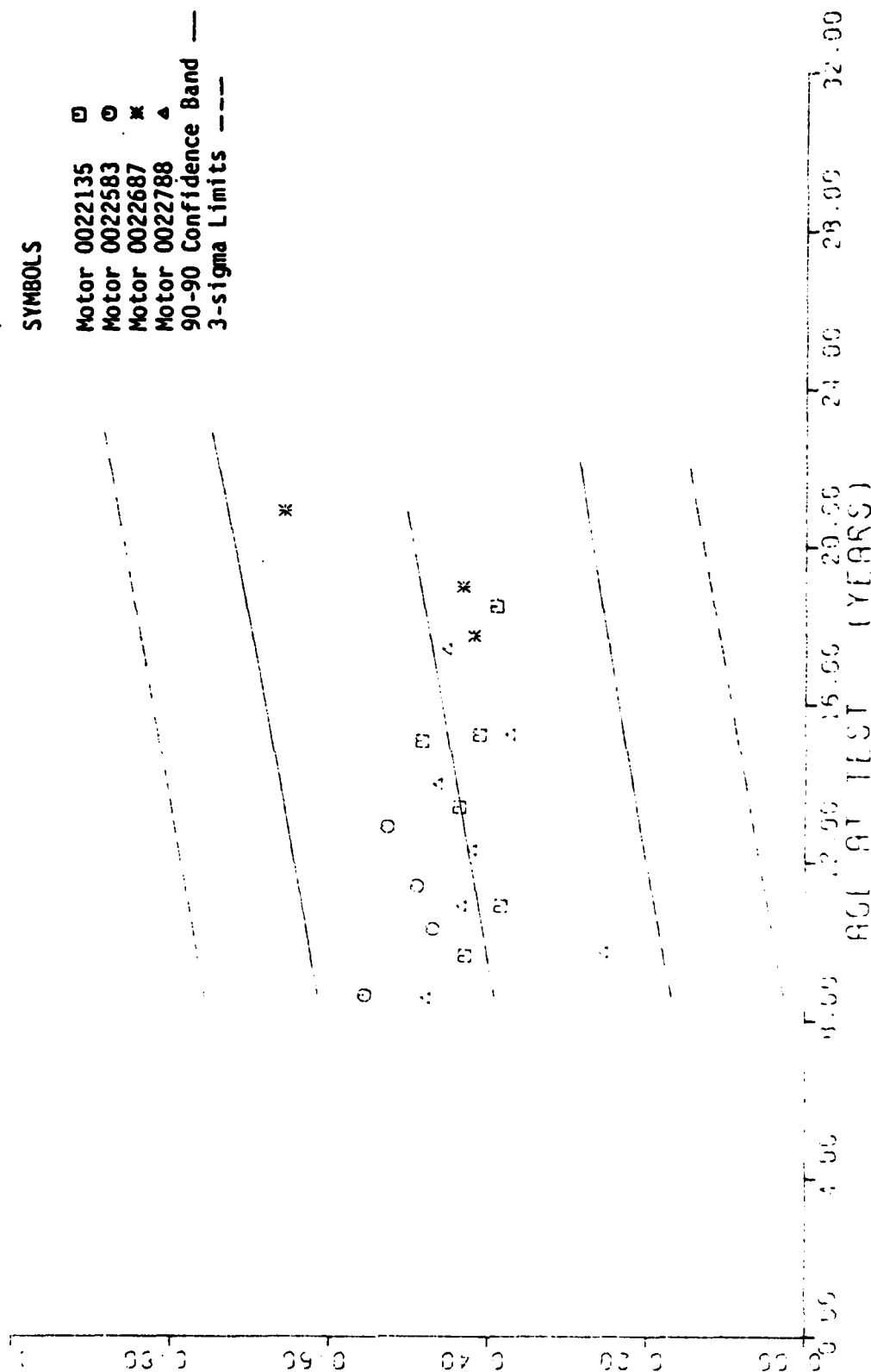
II STAGE CSCT MIRS, OUTER, AXIAL, P.R. HYDRO. CHS=1750 AT 500 PSI. STN RUP <0022697>



PARAMETER = STRESS AT RUPTURE  
UNIT OF MEASURE = IN/IN

## SYMBOLS

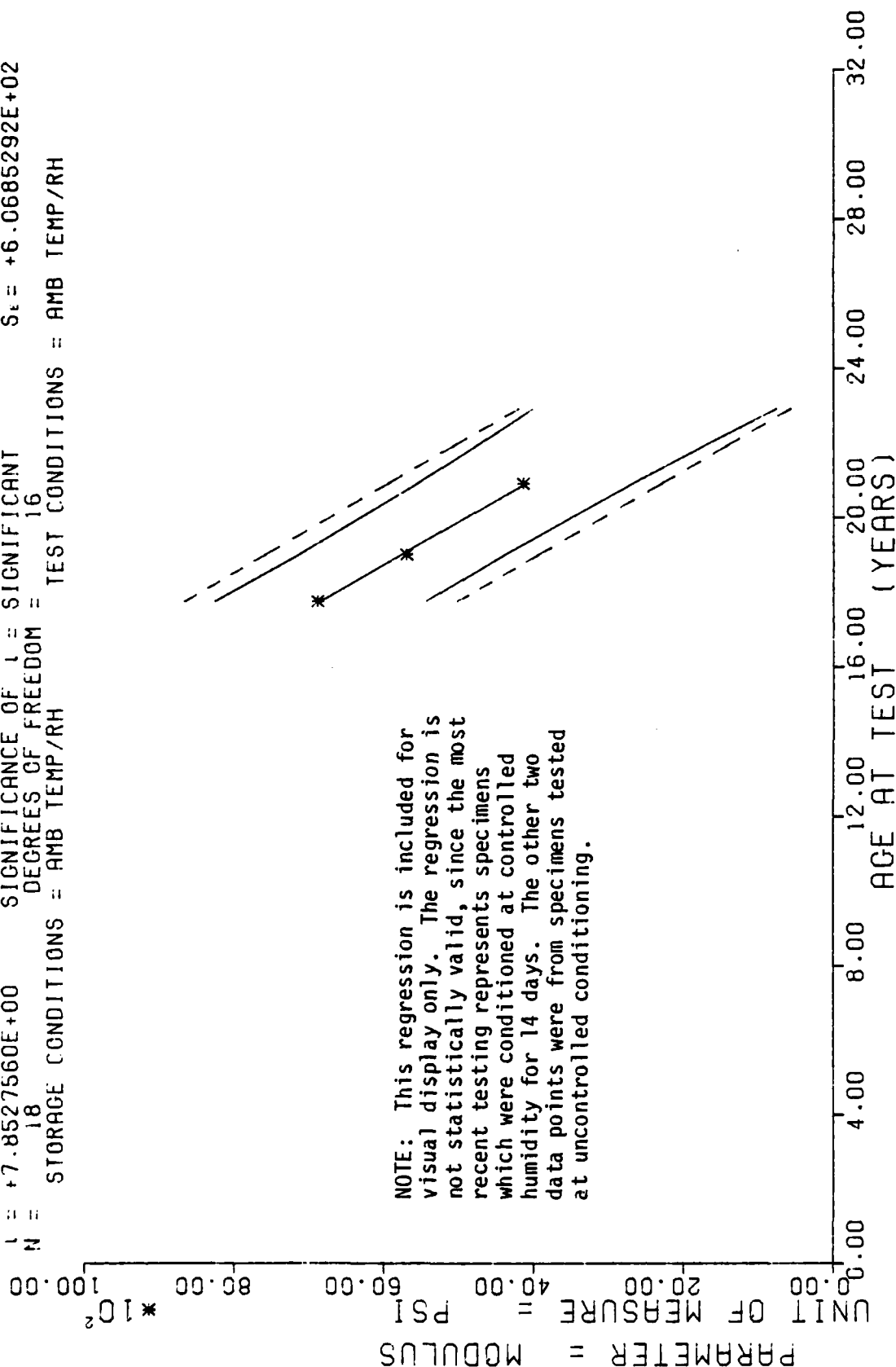
Motor	0022135	□
Motor	0022583	○
Motor	0022687	✕
Motor	0022788	▲
90-90	Confidence Band	
3-sigma	Limits	---



II STAGE 950T M'RS. OUTER AXIAL H R HYDRO (HS-1750 AT 500 PSI STRAIN/RUPTURE

**Figure 26-B**

$Y = ((+2.2155678E+04) + (-7.1874810E+01) * X)$   
 $F = +6.1665777E+01$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = -8.9106063E-01$  SIGNIFICANCE OF R = SIGNIFICANT  
 $L = +7.8527560E+00$  SIGNIFICANCE OF L = SIGNIFICANT  
 $N = 18$  DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

II STAGE DSCT MTRS.OUTER,AXIAL,H.R.HYDRO.CHS=1750 AT 500 PSI,MODULUS <0022687>

Figure 27

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

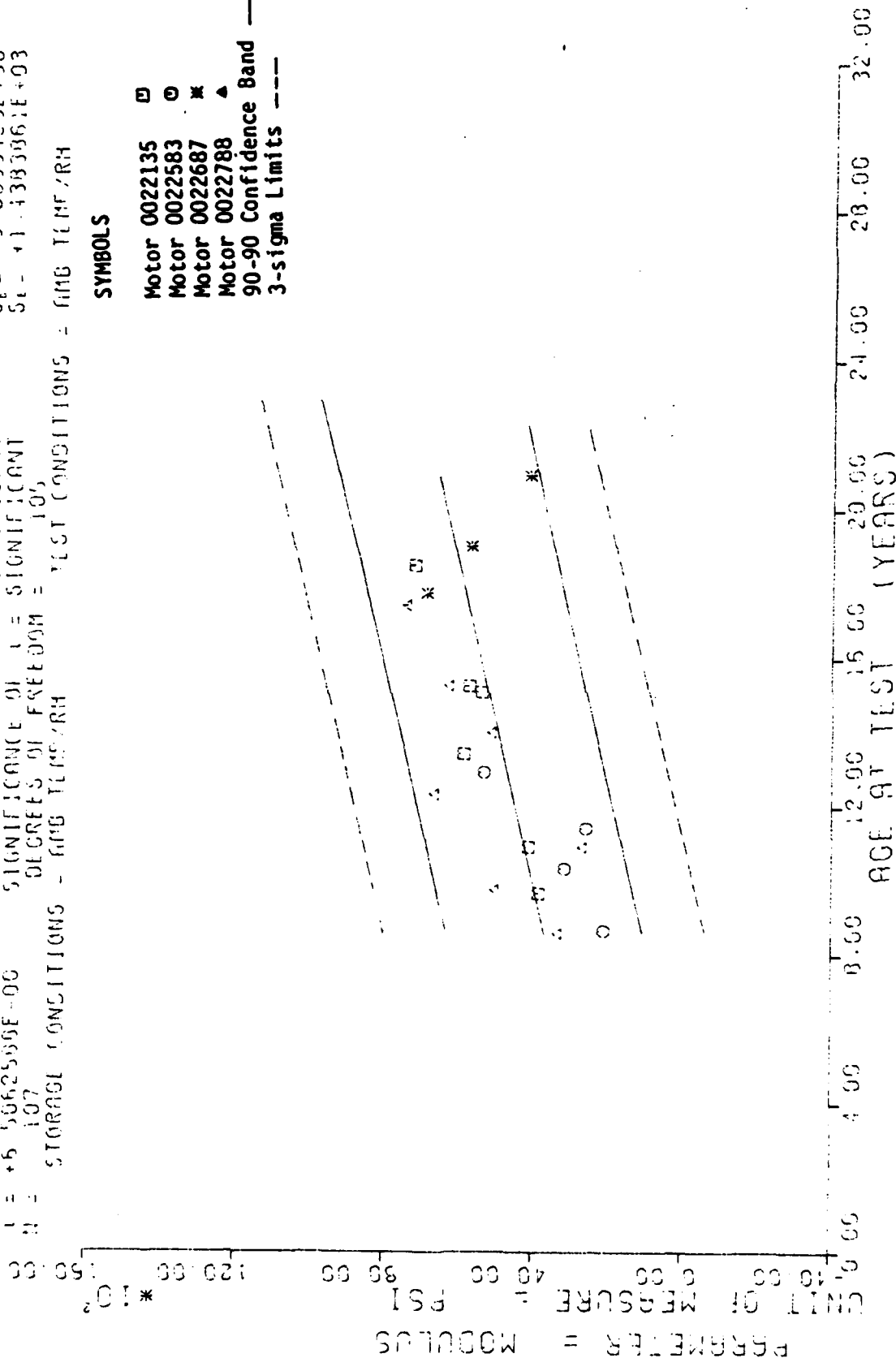
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+6.887320E+03	+9.5891899E+02	+8.1160000E+03	+5.8940000E+03	+6.8463437E+03
228.0	6	+5.7005000E+03	+4.9460903E+02	+6.2510000E+03	+5.1830000E+03	+5.7682187E+03
251.0	6	+4.1418320E+03	+7.7979270E+01	+4.2740000E+03	+4.0400000E+03	+4.1150976E+03

II STAGE DSCT MTRS. OUTER AXIAL H.R. HYDRO. CHS=1750 AT 500 PSI. MODULUS <0022687>

$Y = (0.41629155E+03) + (0.19573009E+01) X$   
 F = +4.2331404E+01 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +5.3602330E+01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +5.5062500E+00 SIGNIFICANCE OF T = SIGNIFICANT  
 D = 107 DEGREES OF FREEDOM = 105  
 STORAGE CONDITIONS - RMB THERM/RH TEST CONDITIONS - RMB THERM/RH

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 ✱  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



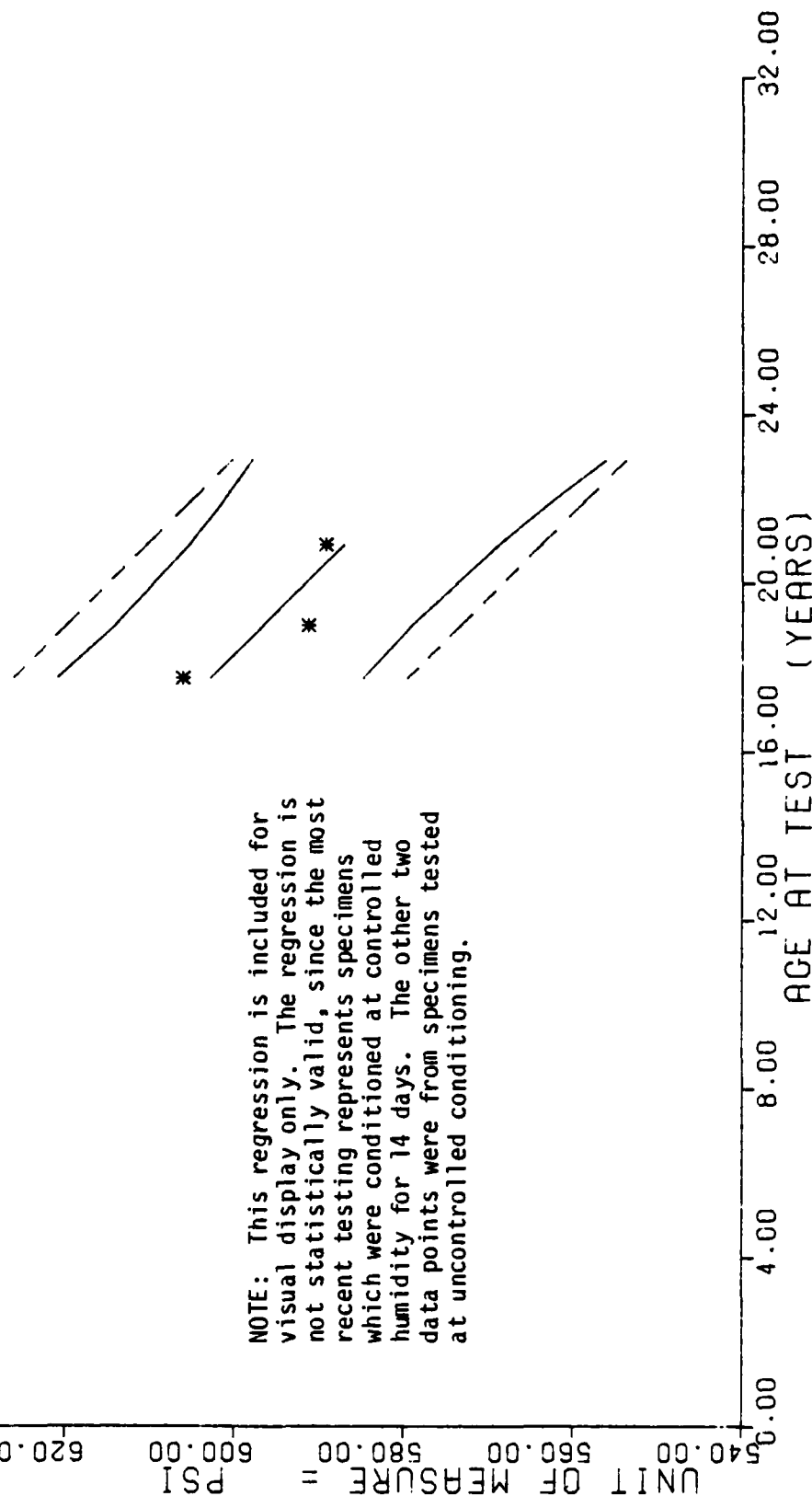
11 STAGE 0501 MTRRS.QUILR.AXIAL.H.R.HYDRO (HS-1750 AT 500 PSI, MODULUS

Figure 27-B

$Y = (( +6.9142854E+02 ) + ( -4.1599560E-01 ) * X )$   
 $F = +1.2644490E+01$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_f = +1.0068458E+01$   
 $R = -6.6440075E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_R = +1.1698712E-01$   
 $t = +3.5559092E+00$  SIGNIFICANCE OF t = SIGNIFICANT  $S_t = +7.7565199E+00$   
 $N = 18$  DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

PARAMETER = MAXIMUM STRESS

UNIT OF MEASURE = PSI



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

11 STAGE DSCT MTRS, INNER, AXIAL, H.R. HYDRO. CHS=1750 AT 500 PSI, MAX STR <0022687>

Figure 28

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

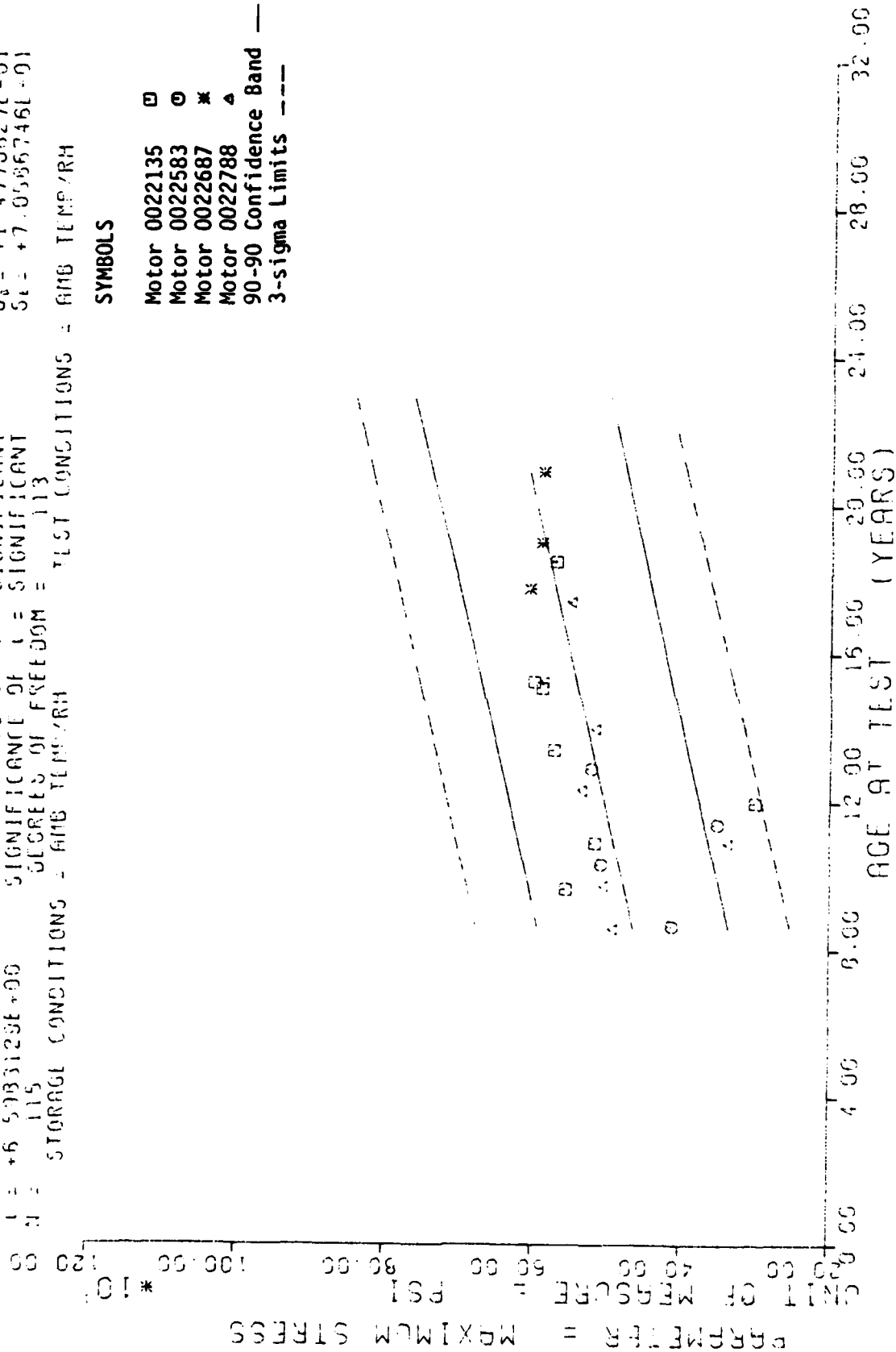
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+6.0607153E+02	+4.52733372E+00	+6.1338989E+02	+5.9927978E+02	+6.0282128E+02
228.0	6	+5.9121142E+02	+1.0456794E+01	+6.0462588E+02	+5.8229980E+02	+5.9658154E+02
251.0	6	+5.8913305E+02	+3.0756719E+00	+5.9379980E+02	+5.8569995E+02	+5.8701342E+02

II STAGE DSCY MTRS.INNER.AXIAL.H.R.HYDRO.CHS=1750 AT 500 PSI.MAX STR <0022687>

F = +4.3537733E+01  
 R = +5.2737967E-01  
 U = +6.5983129E+00  
 N = 115  
 STORAGE CONDITIONS = AMB TEMP/RH  
 Y = 11 +3.5360979E+02 1 1 +0.7161225E-01 1 \* X1  
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF R = SIGNIFICANT  
 SIGNIFICANCE OF U = SIGNIFICANT  
 DEGREES OF FREEDOM = 113  
 TEST CONDITIONS = AMB TEMP/RH

# SYMBOLS

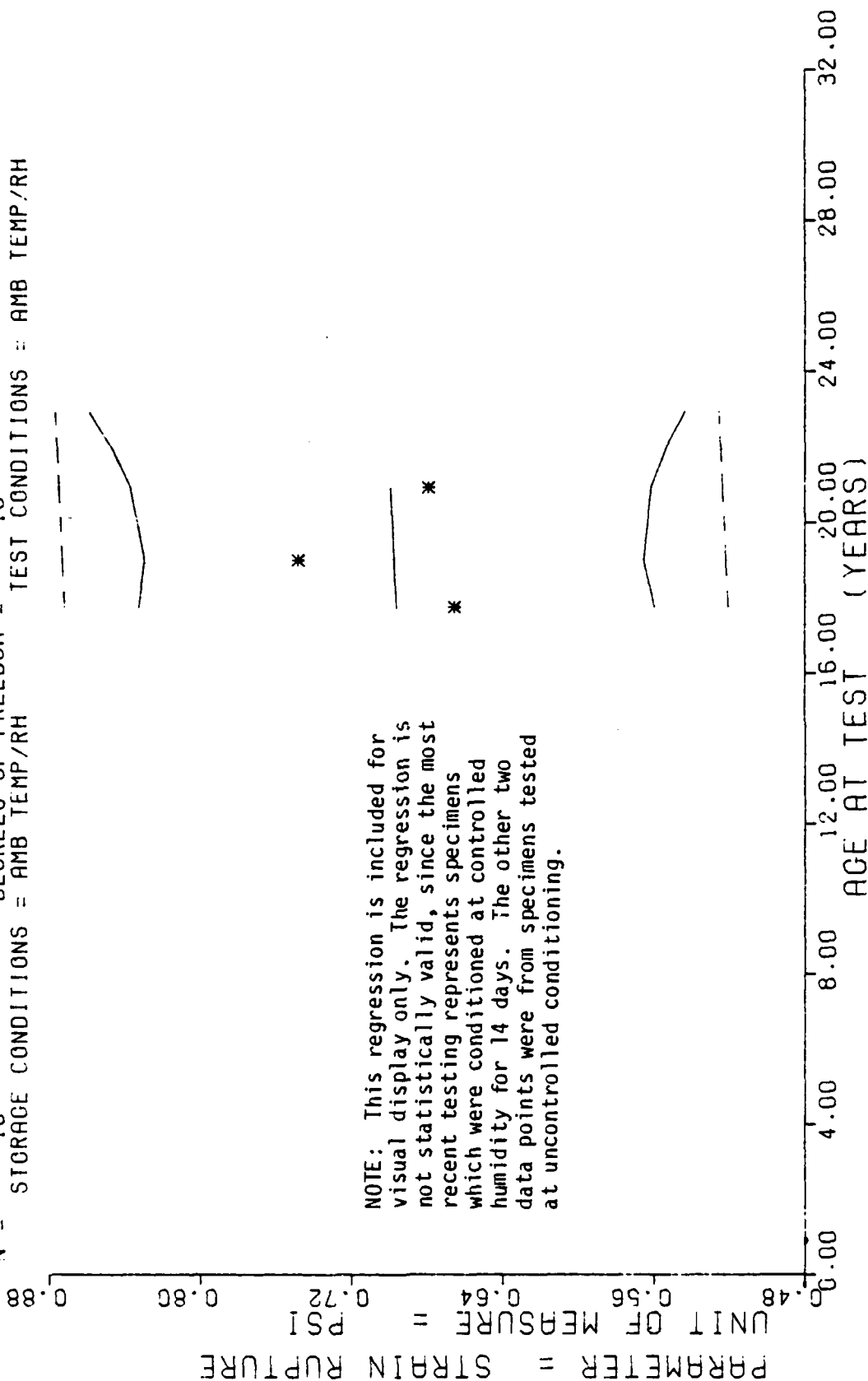
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band —  
 3-sigma Limits ---



11 STAGE 05CT M'RS. INNER AXIAL H.R. HYDRO (HS=1750 AT 500 PSI MAXIMUM STRESS)

Figure 28-B

$Y = (( +6.7924131E-01 ) + ( +7.8867151E-05 ) * X)$   
 F = +7.9826391E-03 SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma_y = +5.6793102E-02$   
 R = +2.2330834E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_e = +8.8271988E-04$   
 L = +8.9345616E-02 SIGNIFICANCE OF L = NOT SIGNIFICANT  $S_e = +5.8526391E-02$   
 N = 18 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

11 STAGE DSCT MRS.INNER,AXIAL,H.R.HYDRO.CHS=1750 AT 500 PSI,STN RUP <0022687>

Figure 29



\*\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*\*

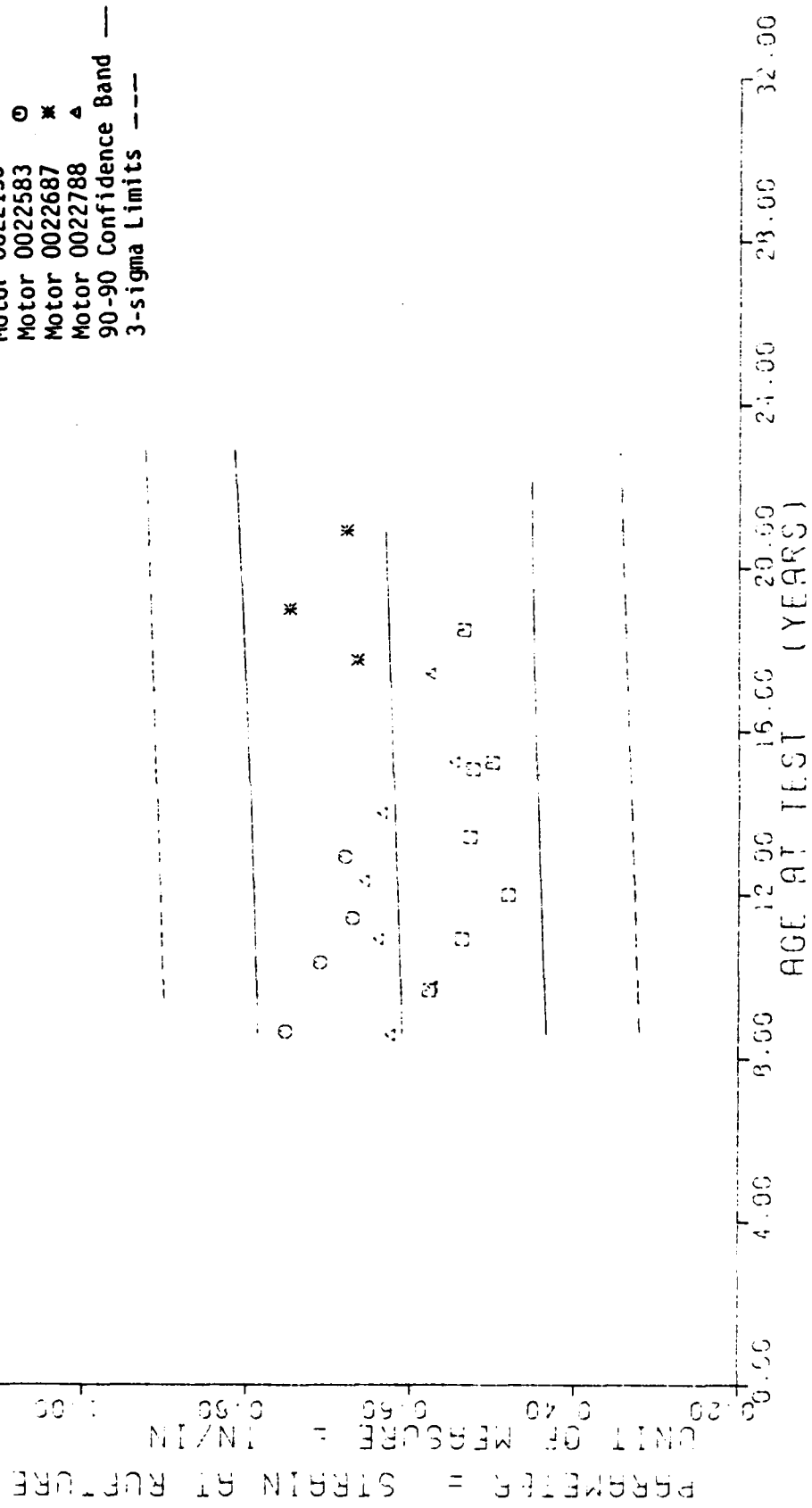
\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+6.6531622E-01	+5.1772293E-02	+7.1319597E-01	+5.8569997E-01	+6.9603997E-01
228.0	6	+7.4758257E-01	+5.4051484E-02	+8.1099598E-01	+6.7419999E-01	+6.9722300E-01
251.0	6	+6.78999954E-01	+2.5564301E-02	+7.0399599E-01	+6.4599596E-01	+6.9903695E-01

II STAGE DSCT MIRS. INNER. AXIAL. H. R. HYDRO. CHS=1750 AT 500 PSI. STN RUP <0022687>

Y = 11 45 3522591E-01 J + 11 15292401-04 J \* X1  
 F = +5 17387961-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 R = +6 7550332E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 T = +7 1971330E-01 SIGNIFICANCE OF T = NOT SIGNIFICANT  
 D = 115 DEGREES OF FREEDOM = 113  
 STORAGE CONDITIONS - AMBI TEMP/RRH TEST CONDITIONS - AMBI TEMP/RRH

**SYMBOLS**  
 Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----

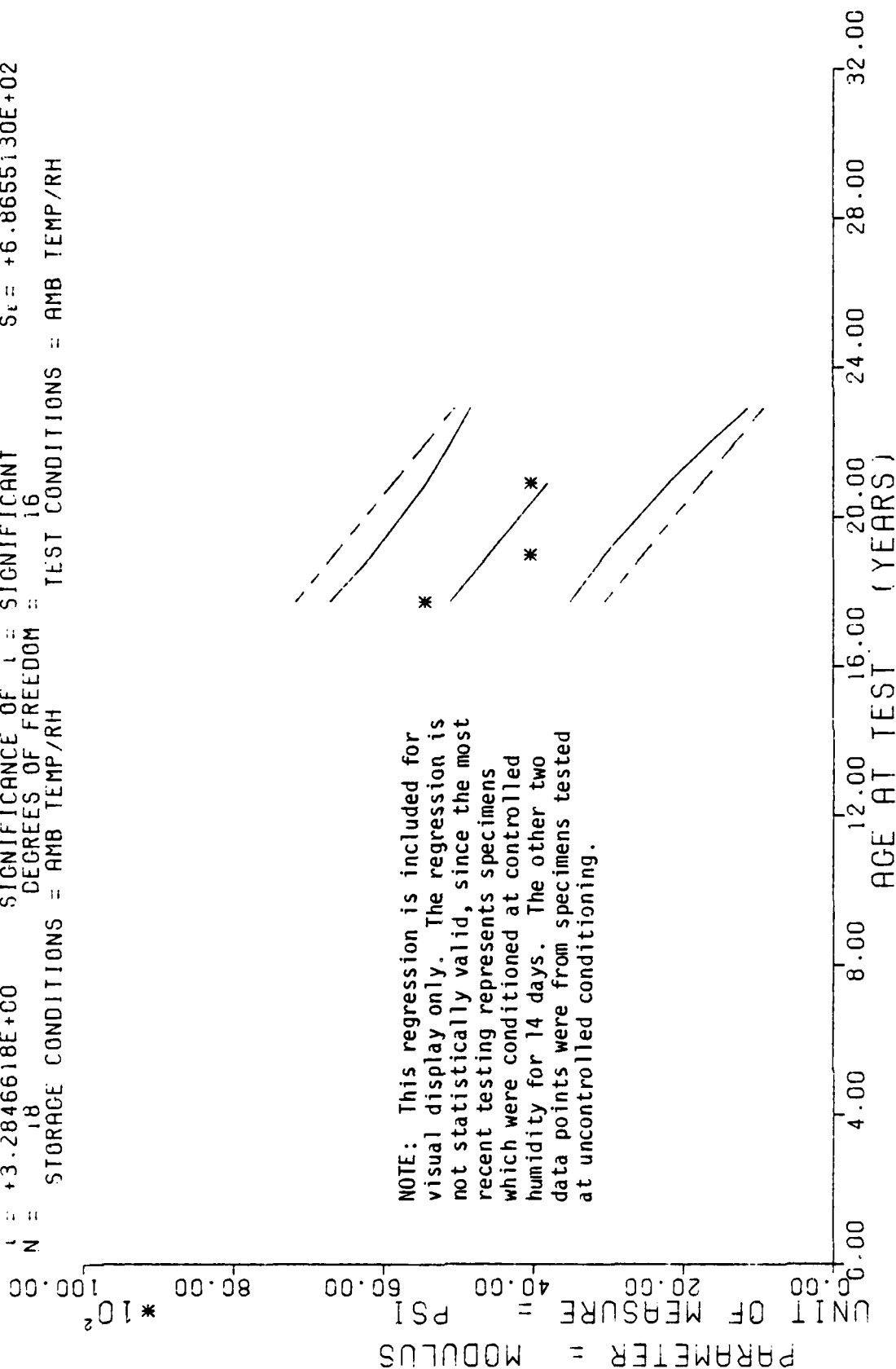


II STAGE 050T MRS. INNER, AXIAL, H.R. HYDRO CHS-1750 AT 500 PSI, STRAIN/RUPTURE

Figure 29-B

$Y = (( +1.2351704E+04 ) + ( -3.4012208E+01 ) * X)$   
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF R = SIGNIFICANT  
 SIGNIFICANCE OF t = SIGNIFICANT  
 DEGREES OF FREEDOM = 16  
 STORAGE CONDITIONS = AMB TEMP/RH  
 TEST CONDITIONS = AMB TEMP/RH

F = +1.0789003E+01  
 R = -6.3461800E-01  
 t = +3.2846618E+00  
 N = 18



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represented specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

II STAGE DSCT MTRS, INNER, AXIAL, H.R. HYDRO. CHS=1750 AT 500 PSI, MODULUS <0022687>

Figure 30

\*\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

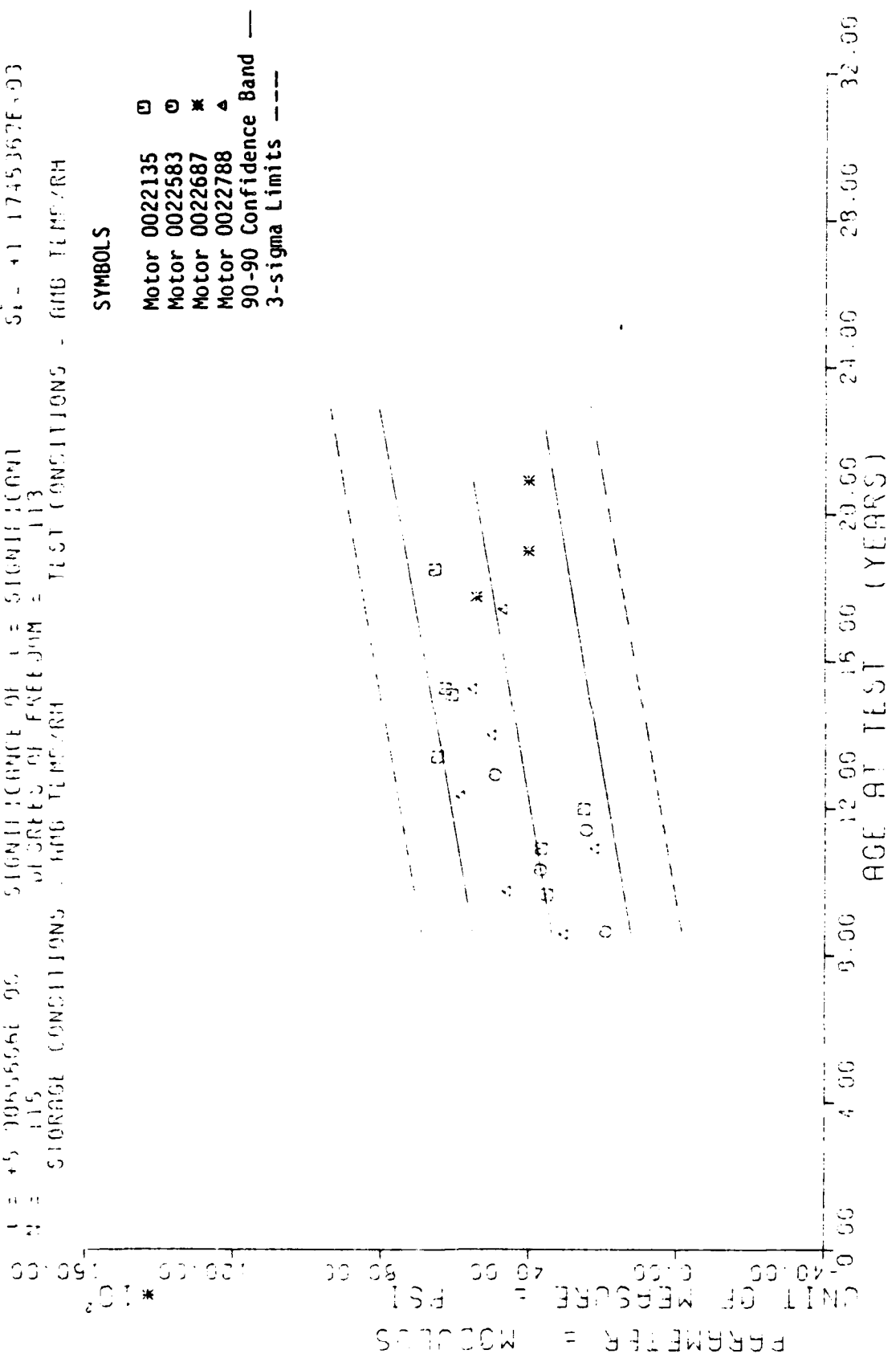
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	6	+5.4455000E+03	+5.5602589E+02	+6.1400000E+03	+4.6490000E+03	+5.1071015E+03
228.0	6	+4.0378332E+03	+7.2963934E+02	+5.2340000E+03	+3.2330000E+03	+4.5969179E+03
251.0	6	+4.0355332E+03	+1.8431133E+02	+4.3930000E+03	+3.8830000E+03	+3.8146406E+03

11 STAGE CSCT MTRS, INNER, AXIAL, H.R. HYDRO, CHS=1750 AT 500 PSI, MODULUS <0022687>

F = +3 485745E-01  
 R = +4 057099E-01  
 T = +5 006556E-00  
 H = 115  
 STORAGE CONDITIONS - 6MB TEMPRH  
 DEGREES OF FREEDOM = 113  
 TEST CONDITIONS - 6MB TEMPRH  
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF R = SIGNIFICANT  
 SIGNIFICANCE OF T = SIGNIFICANT  
 S<sub>F</sub> = +1 337765E+03  
 S<sub>R</sub> = +2.457776E+00  
 S<sub>T</sub> = +1 1745367E+03

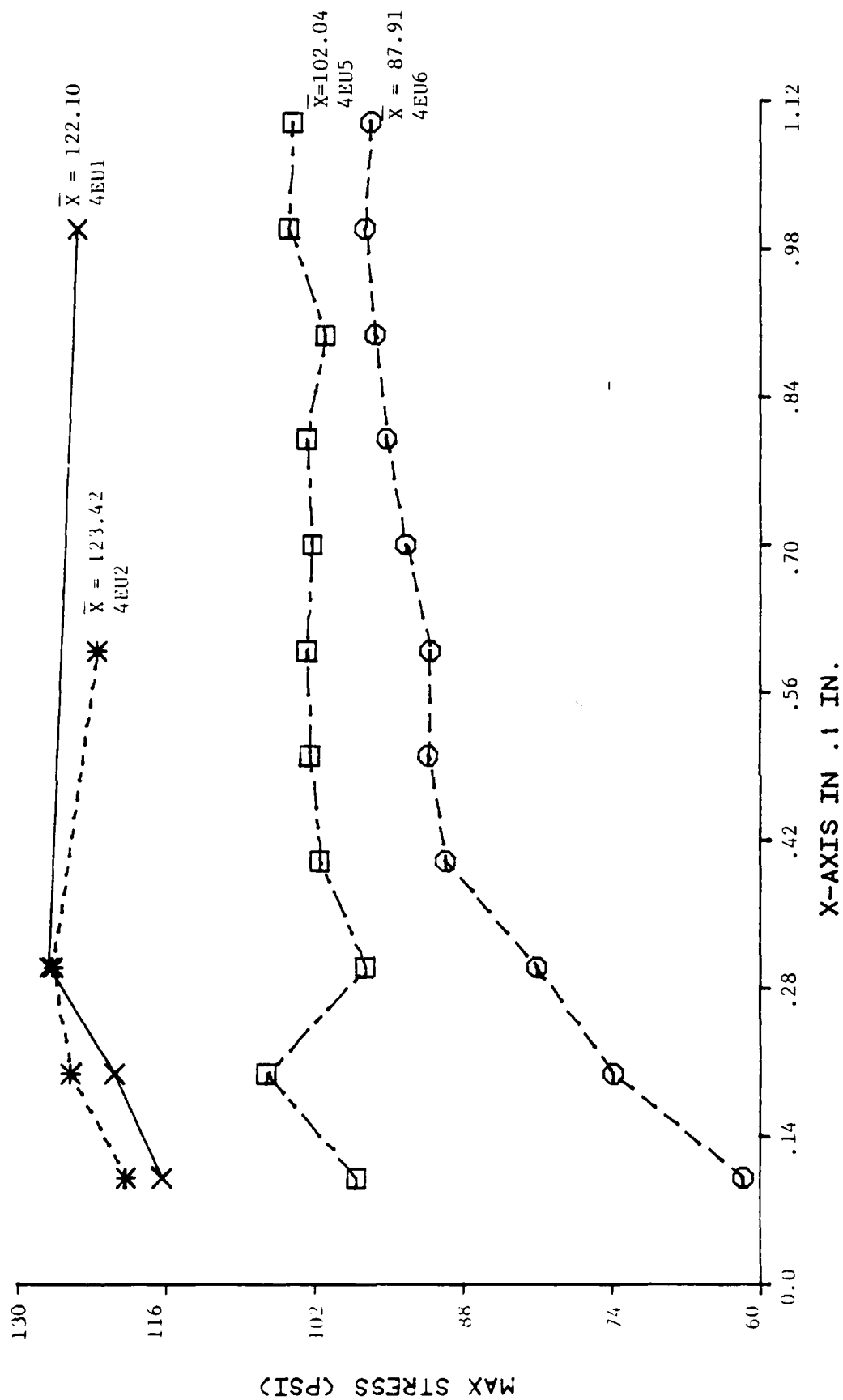
**SYMBOLS**

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----

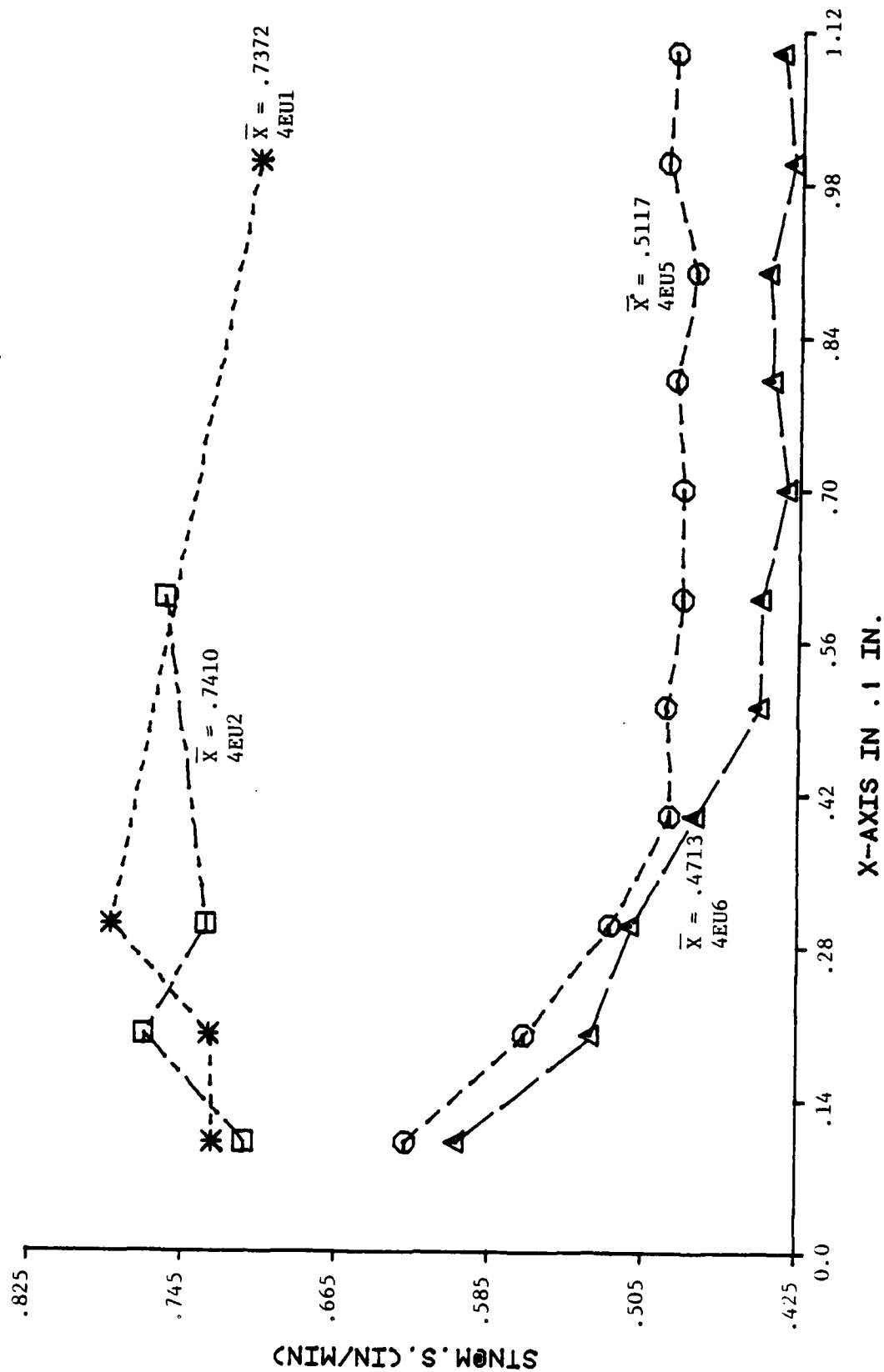


11 STAGE DUCT M'RS. INNER AXIAL H & HYDRO CHS-1750 AT 500 PSI, MODULUS

Figure 30-B

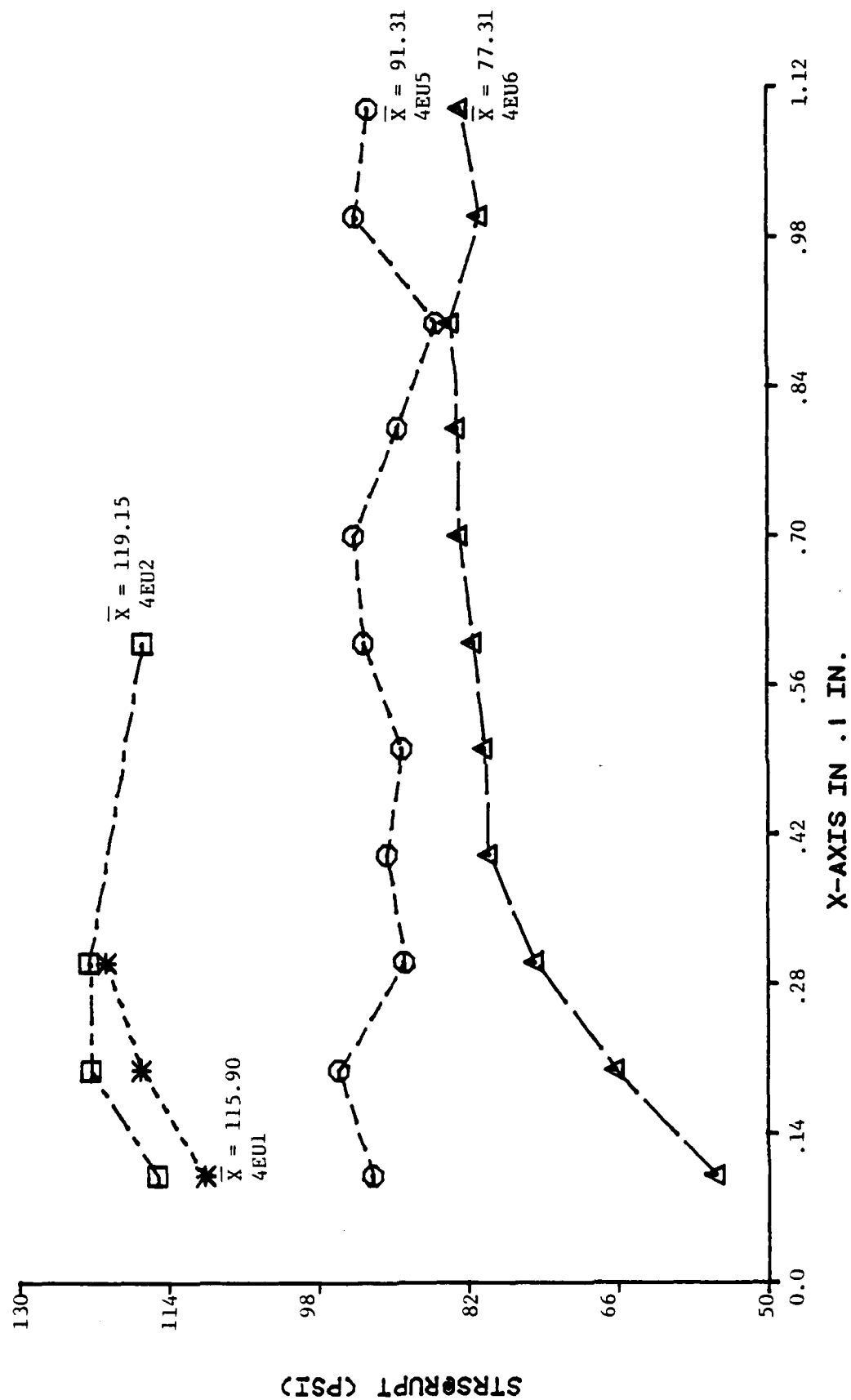


OUTER TEST COMPARISON OF MINITHIN MAX STRESS VALUES FOR 4 BLOCKS



OUTER TEST COMPARISON OF MINITHIN STRN. @ MAX STRS. VALUES FOR 4 BLOCKS

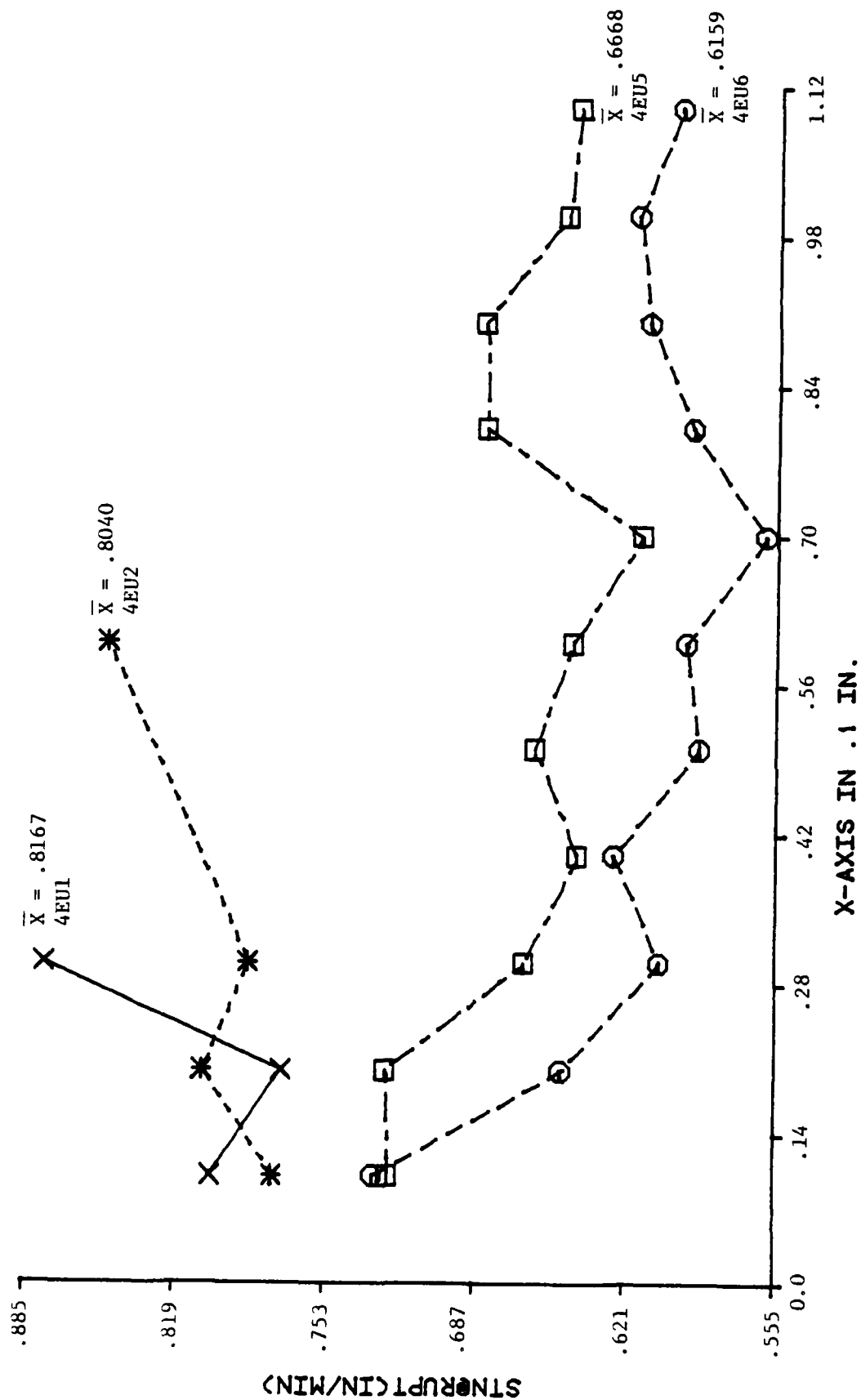
Figure 32



OUTER TEST COMPARISON OF MINITHIN STRESS @ RUPTURE VALUES FOR 4 BLOCKS

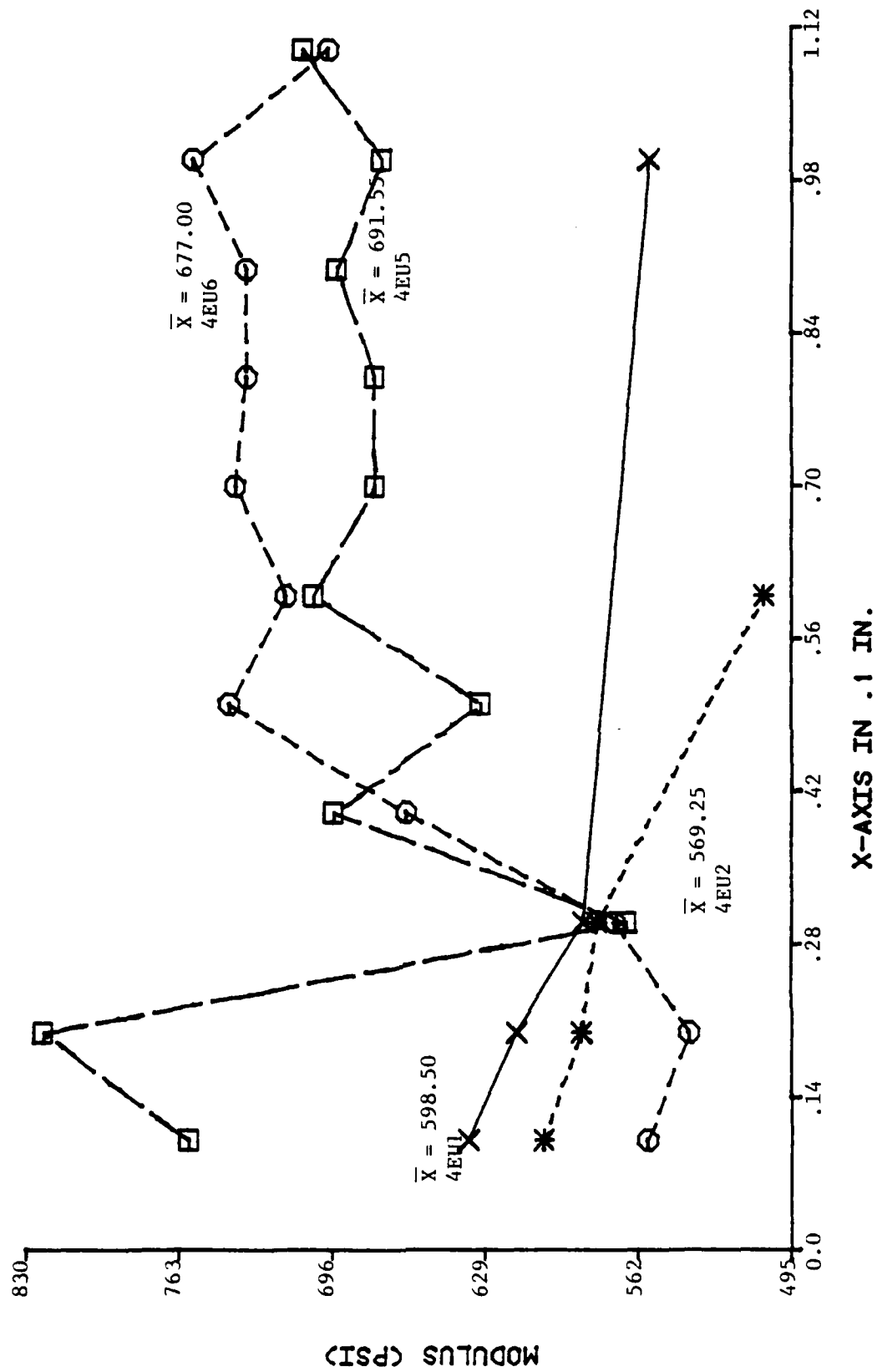
Figure 33





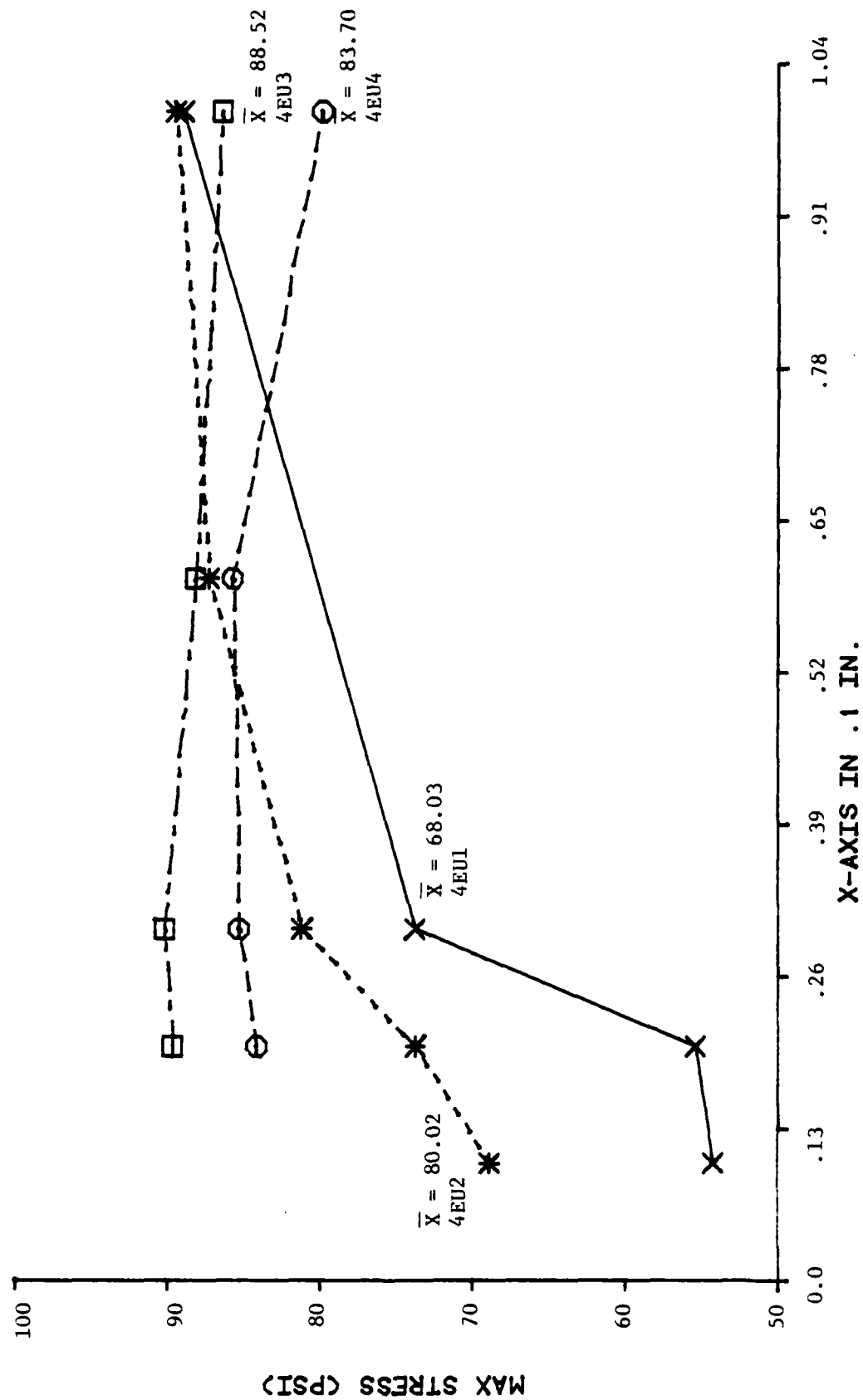
OUTER TEST COMPARISON OF MINITHIN STRAIN ○ RUPTURE VALUES FOR 4 BLOCKS

Figure 34



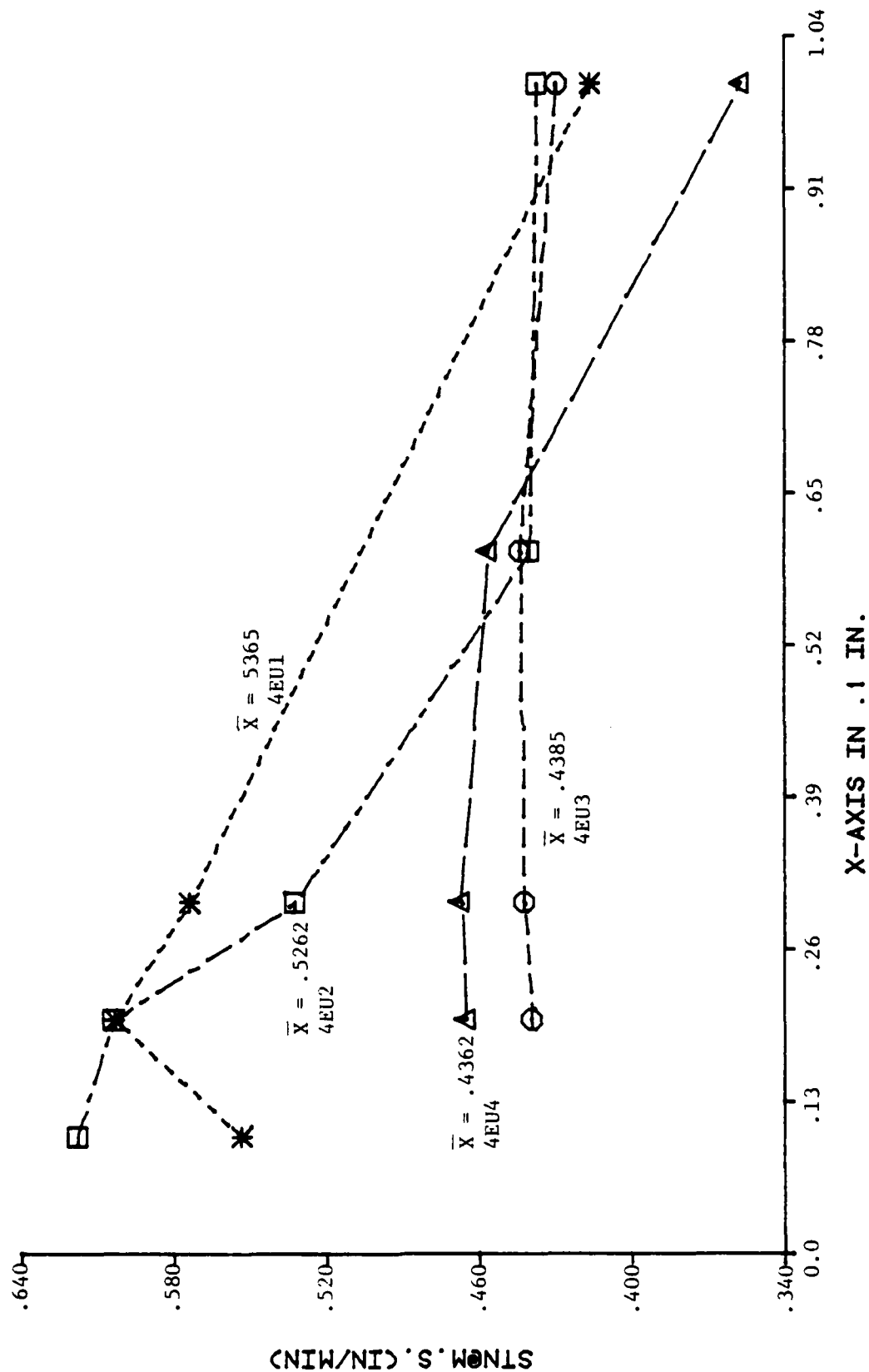
OUTER TEST COMPARISON OF MINITHIN MODULUS VALUES FOR 4 BLOCKS

Figure 35



INNER TEST COMPARISON OF MINITHIN MAX STRESS VALUES FOR 4 BLOCKS

Figure 36



INNER TEST COMPARISON OF MINITHIN STRN. @ MAX STRS. VALUES FOR 4 BLOCKS

Figure 37

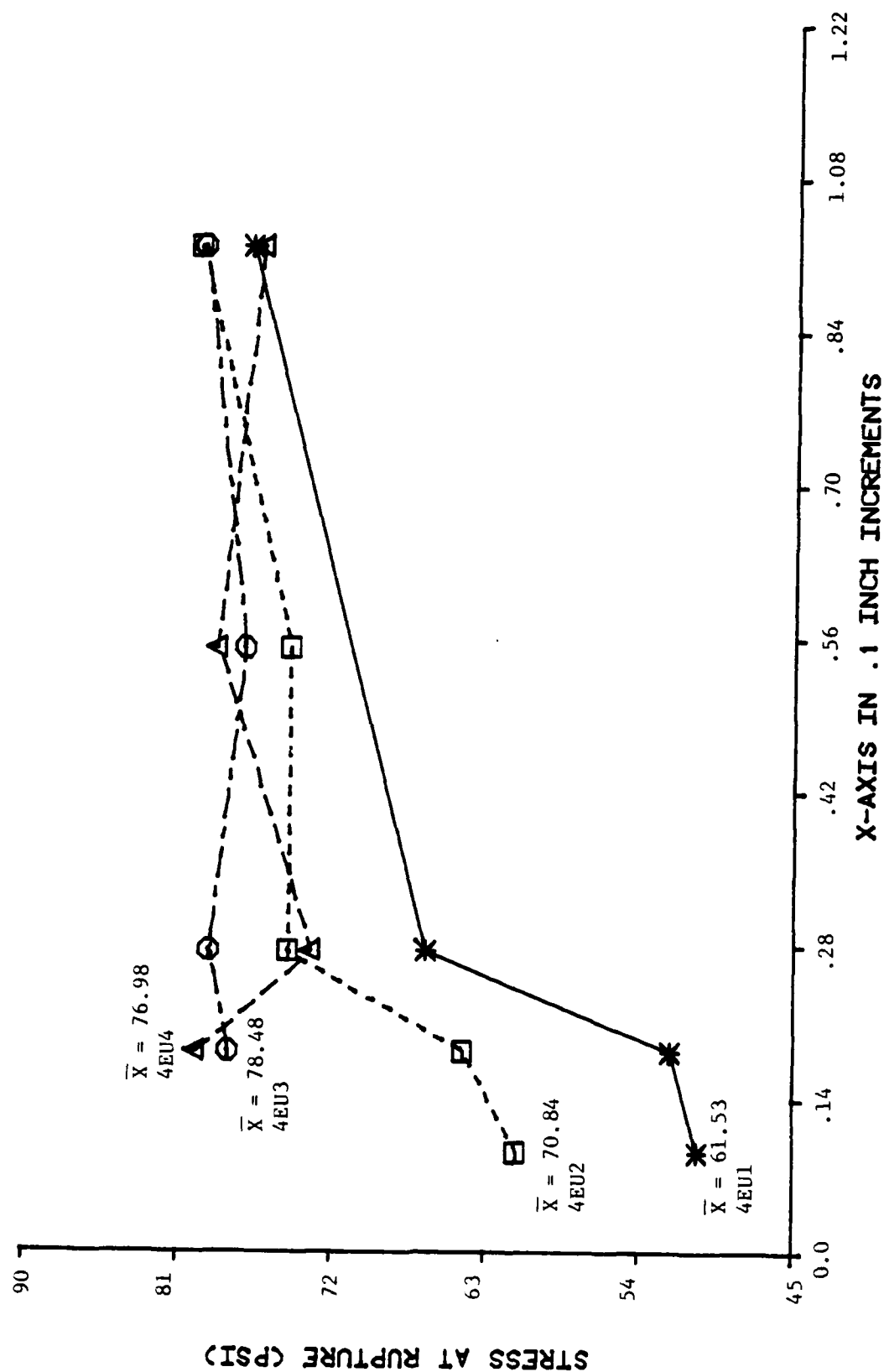
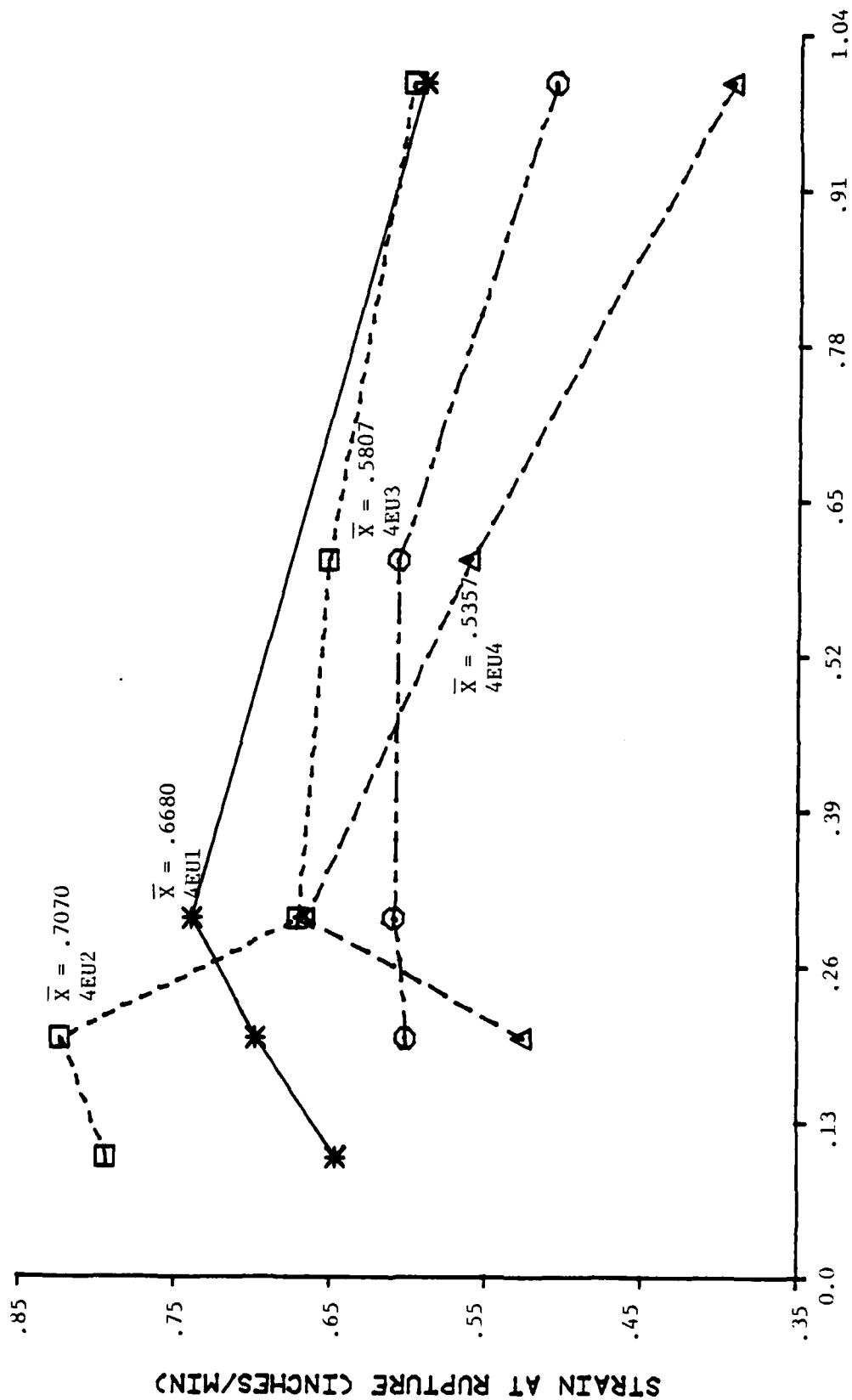


Figure 38



INNER TEST COMPARISON OF MINITHIN STRAIN @ RUPTURE VALUES FOR 4 BLOCKS

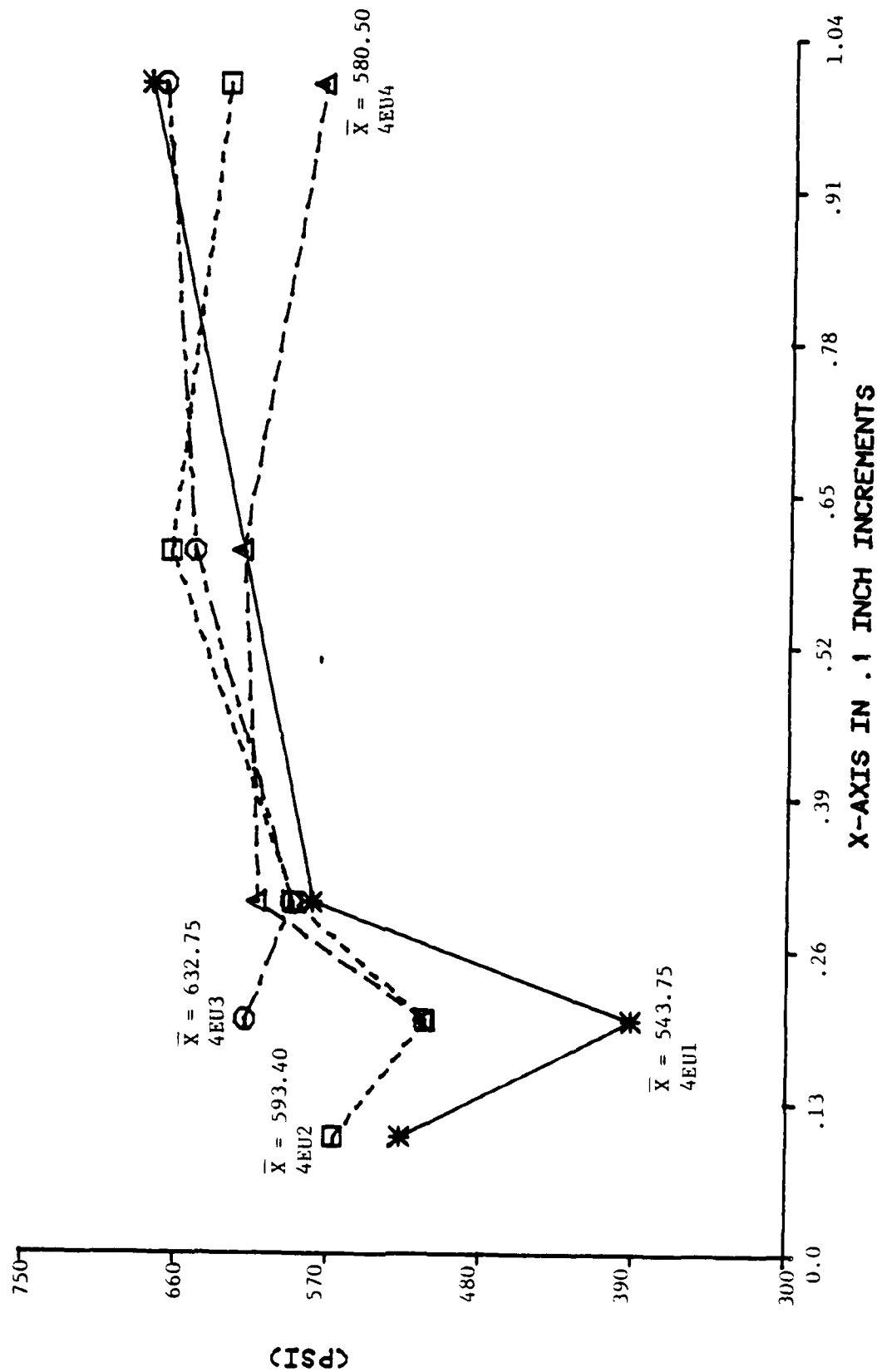
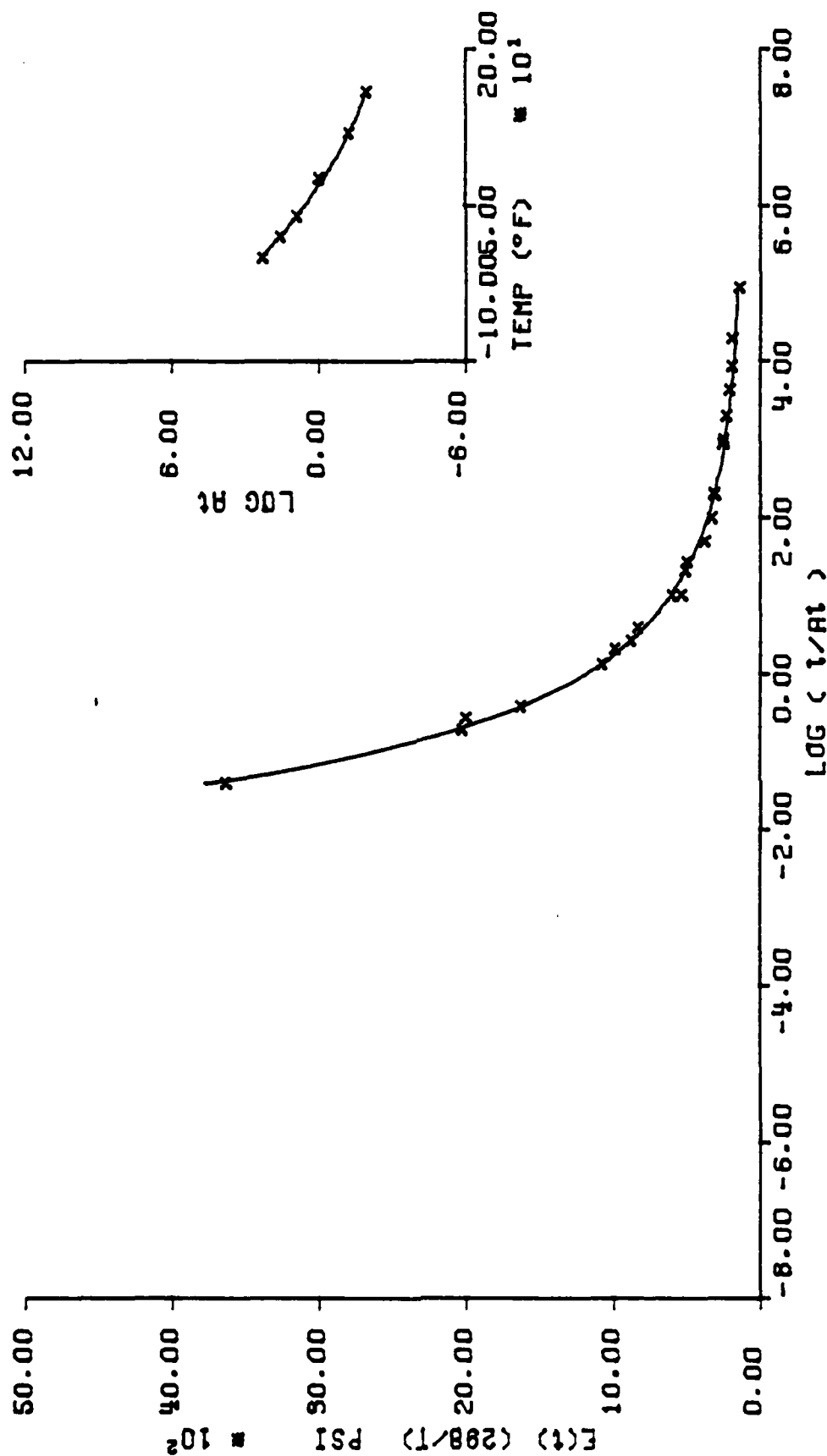


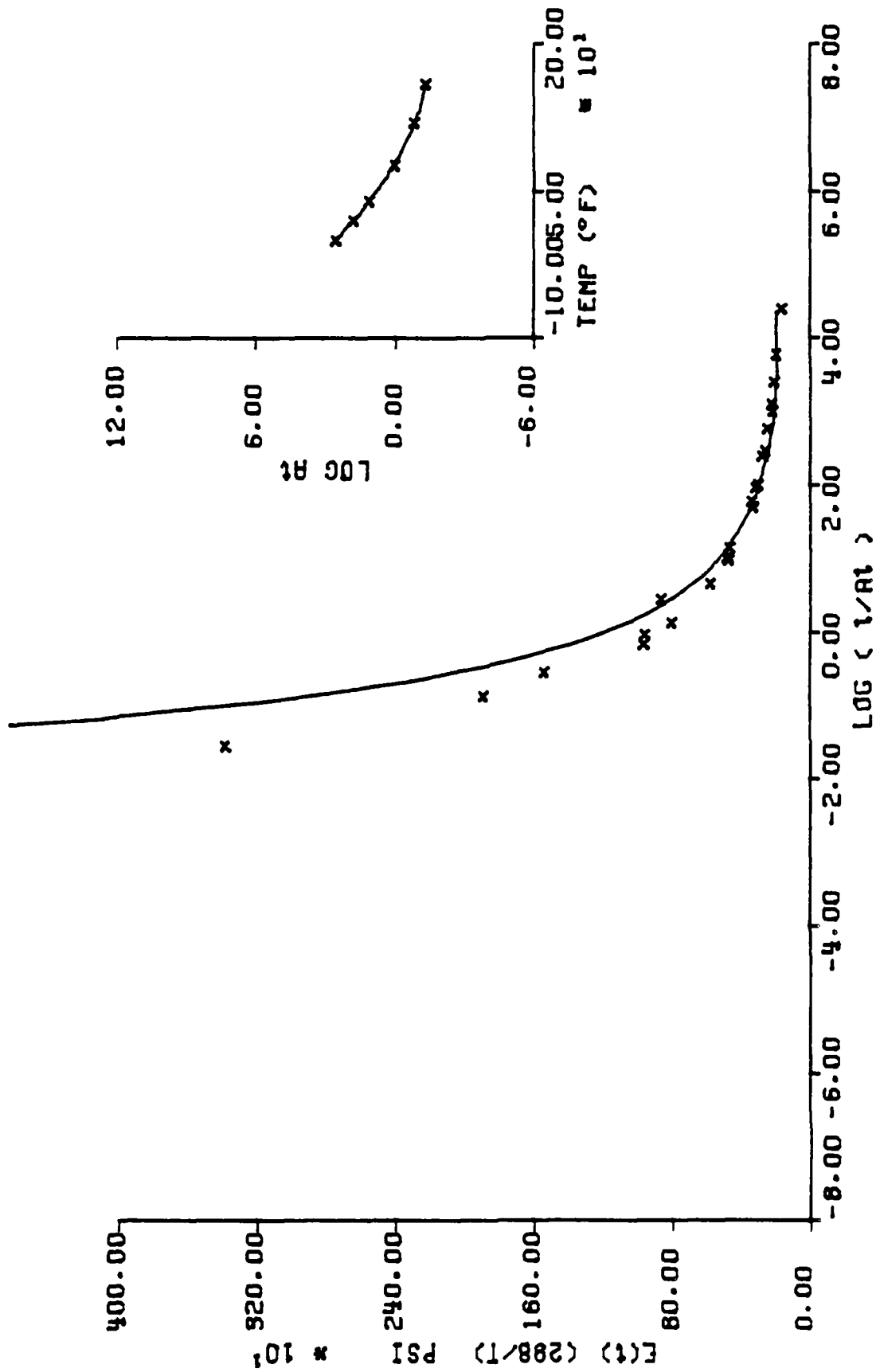
Figure 40



STAGE II DISCTED MOTOR(0022687). OUTER.9% STRAIN. MASTER STRESS RELAXATION.1985.

Figure 41

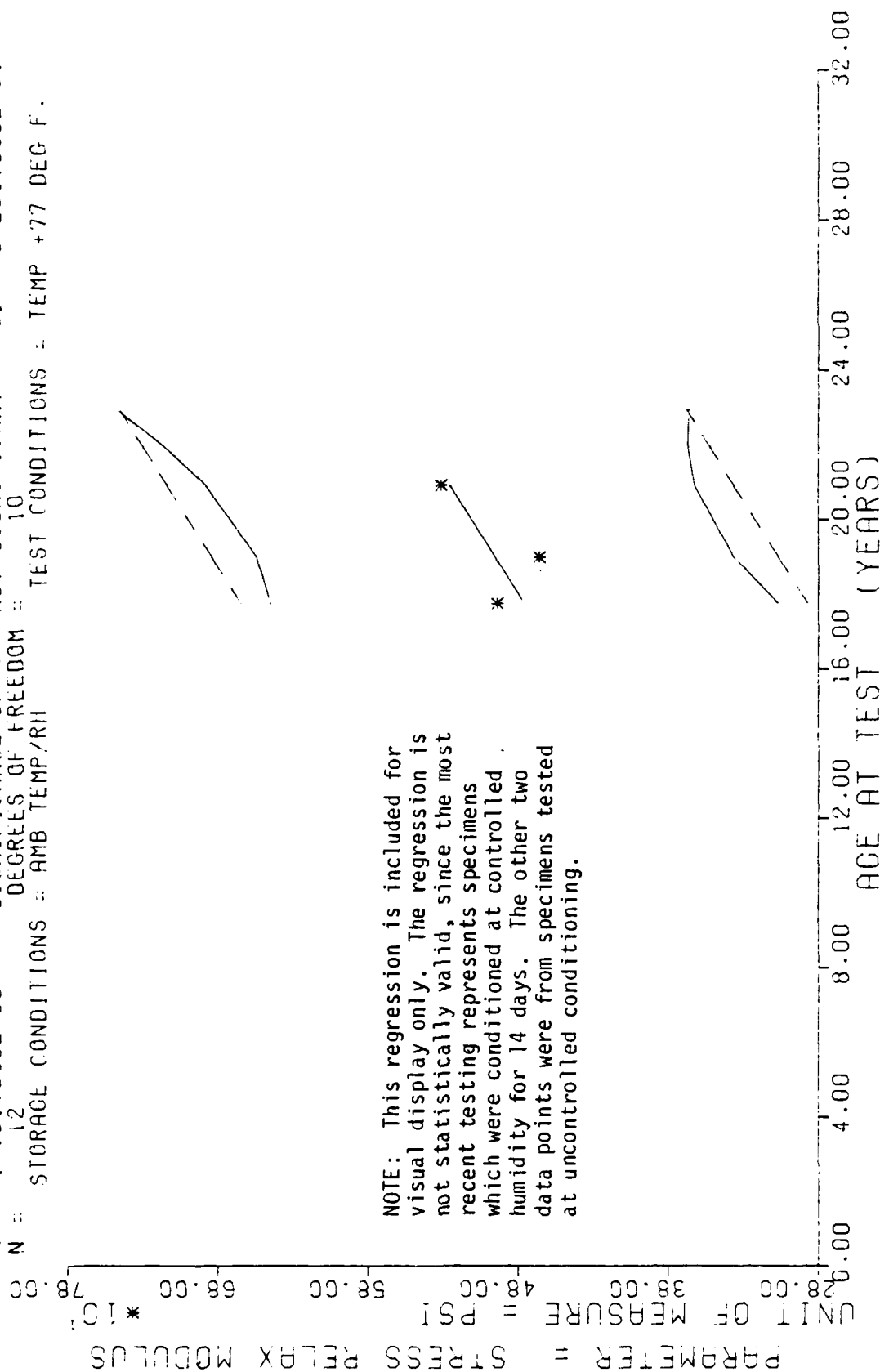




STAGE II DISCTED MOTOR(0022687). INNER.9% STRAIN, MASTER STRESS RELAXATION.1985.

Figure 42

Y = (( +1.9990354E+02 ) + ( +1.2952129E+00 ) \* X )  
 F = +1.3265495E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma_1 = +6.3823798E+01$   
 R = +3.4222593E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_0 = +1.1245517E+00$   
 t = +1.1517593E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_t = +6.2897035E+01$   
 N = 12 DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = AMB TEMP/RIH TEST CONDITIONS = TEMP +77 DEG F.



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

STAGE 11, DISSECTED MTRS, OUTER, STRESS RELAX, 3 PERCENT, +77 DEG, 10/SEC. ~0022687>

Figure 43

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+4.9366650E+02	+5.5075705E+01	+5.4700000E+02	+4.3700000E+02	+4.7578369E+02
228.0	3	+4.6566650E+02	+7.4332585E+01	+5.2700000E+02	+3.8300000E+02	+4.9521191E+02
251.0	6	+5.3082325E+02	+6.1091461E+01	+6.0300000E+02	+4.5300000E+02	+5.2500195E+02

STAGE II, DISSECTED MTRS. OUTER, STRESS RELAX, 3 PERCENT, +77 DEG, 10/SEC. <0022697>

Figure 43-A



F = 14.5512795E 01      SIGNIFICANCE OF F = 1.45669359E 01      1 \* X1  
 R = 0.9365750E 01      SIGNIFICANCE OF R = 1.40299076E 01  
 T = 16.1458359E 01      SIGNIFICANCE OF T = 1.46953101E 01  
 D.F. = 12      DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = 6MB 1100 GRH      TEST CONDITIONS = TIME 477 DLS F.



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.



0.00 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00  
 AGE AT TEST (YEARS)

STRESS RELAXATION TESTS: STRESS RELAX. 2 PERCENT, 177 DLS, 1100 GRH, 6MB 1100 GRH

Figure 44

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+3.5200000E+02	+4.1509035E+01	+3.9300000E+02	+3.1000000E+02	+3.4426879E+02
228.0	3	+3.4000000E+02	+5.6824290E+01	+3.9300000E+02	+2.8000000E+02	+3.5277294E+02
251.0	6	+3.6833325E+02	+4.7911028E+01	+4.2700000E+02	+3.0300000E+02	+3.6581225E+02

STAGE II, DISSECTED MTRS, OUTER, STRESS RELAX, 3 PERCENT, +77 DEG, 50/SEC, <0022687>

(X-96-17686) - 063975

Significant at  $F = 0.01$  level

100% of the respondents were satisfied with the service.

ULCER OF FÆFOM = 75

HR 3111, 10-14

## SYMBOLS

Motor 0022135

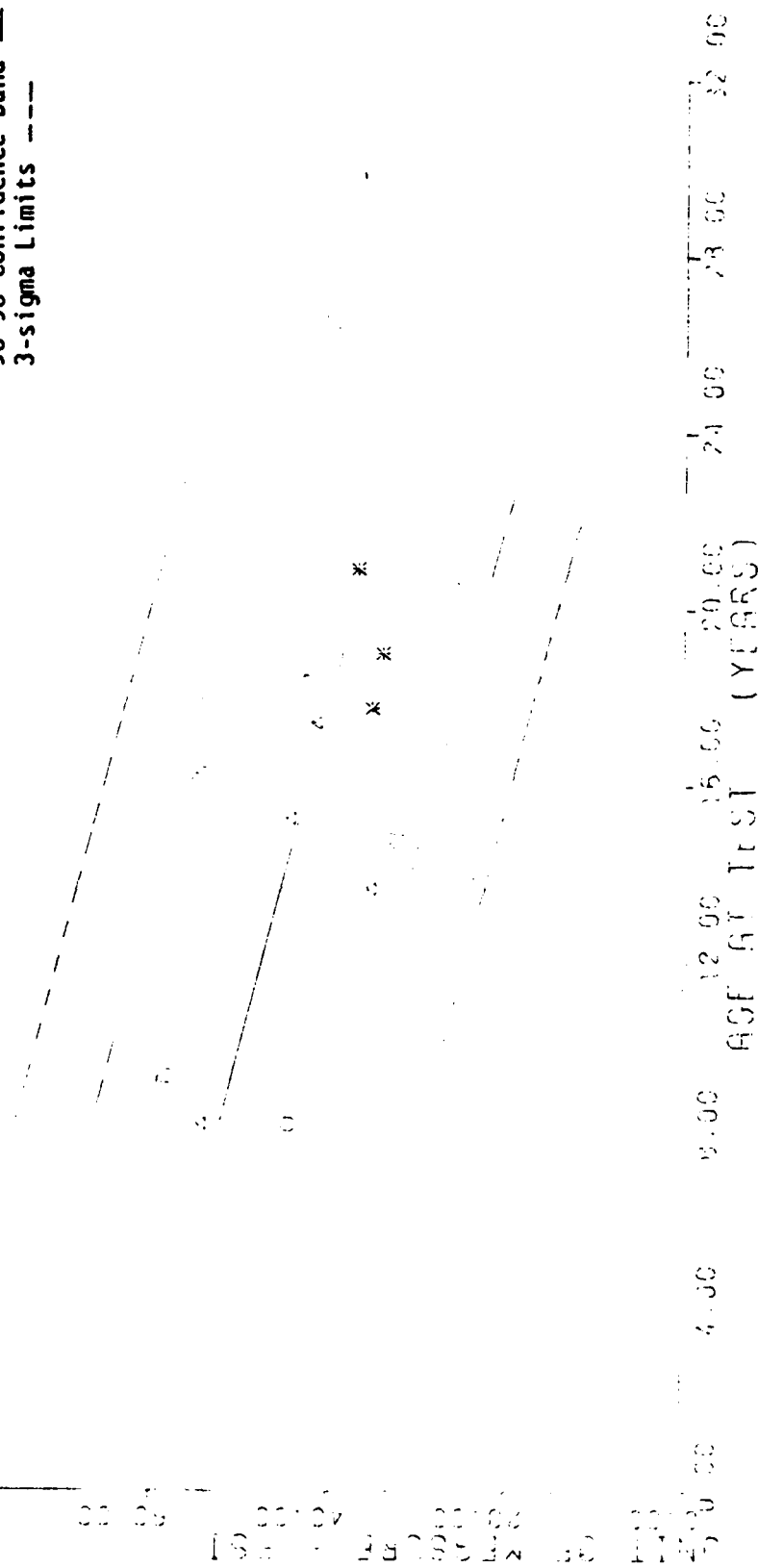
Motor 0022583 0

Motor 0022687

**Motor 0022788 ▲**

**90-90 Confidence Band —**

### 3-sigma Limits ---

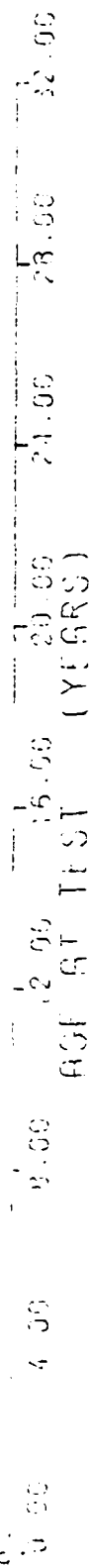


60-11, 1950-1953, 1955-1956, 1958-1959, 1961-1962, 1964-1965, 1967-1968, 1970-1971, 1973-1974, 1976-1977, 1979-1980, 1982-1983, 1985-1986, 1988-1989, 1991-1992, 1994-1995, 1997-1998, 2000-2001, 2003-2004, 2006-2007, 2009-2010, 2012-2013, 2015-2016, 2018-2019, 2021-2022, 2023-2024, 2025-2026, 2027-2028, 2029-2030, 2031-2032, 2033-2034, 2035-2036, 2037-2038, 2039-2040, 2041-2042, 2043-2044, 2045-2046, 2047-2048, 2049-2050, 2051-2052, 2053-2054, 2055-2056, 2057-2058, 2059-2060, 2061-2062, 2063-2064, 2065-2066, 2067-2068, 2069-2070, 2071-2072, 2073-2074, 2075-2076, 2077-2078, 2079-2080, 2081-2082, 2083-2084, 2085-2086, 2087-2088, 2089-2090, 2091-2092, 2093-2094, 2095-2096, 2097-2098, 2099-2100, 2101-2102, 2103-2104, 2105-2106, 2107-2108, 2109-2110, 2111-2112, 2113-2114, 2115-2116, 2117-2118, 2119-2120, 2121-2122, 2123-2124, 2125-2126, 2127-2128, 2129-2130, 2131-2132, 2133-2134, 2135-2136, 2137-2138, 2139-2140, 2141-2142, 2143-2144, 2145-2146, 2147-2148, 2149-2150, 2151-2152, 2153-2154, 2155-2156, 2157-2158, 2159-2160, 2161-2162, 2163-2164, 2165-2166, 2167-2168, 2169-2170, 2171-2172, 2173-2174, 2175-2176, 2177-2178, 2179-2180, 2181-2182, 2183-2184, 2185-2186, 2187-2188, 2189-2190, 2191-2192, 2193-2194, 2195-2196, 2197-2198, 2199-2200, 2201-2202, 2203-2204, 2205-2206, 2207-2208, 2209-2210, 2211-2212, 2213-2214, 2215-2216, 2217-2218, 2219-2220, 2221-2222, 2223-2224, 2225-2226, 2227-2228, 2229-2230, 2231-2232, 2233-2234, 2235-2236, 2237-2238, 2239-2240, 2241-2242, 2243-2244, 2245-2246, 2247-2248, 2249-2250, 2251-2252, 2253-2254, 2255-2256, 2257-2258, 2259-2260, 2261-2262, 2263-2264, 2265-2266, 2267-2268, 2269-2270, 2271-2272, 2273-2274, 2275-2276, 2277-2278, 2279-2280, 2281-2282, 2283-2284, 2285-2286, 2287-2288, 2289-2290, 2291-2292, 2293-2294, 2295-2296, 2297-2298, 2299-2300, 2301-2302, 2303-2304, 2305-2306, 2307-2308, 2309-2310, 2311-2312, 2313-2314, 2315-2316, 2317-2318, 2319-2320, 2321-2322, 2323-2324, 2325-2326, 2327-2328, 2329-2330, 2331-2332, 2333-2334, 2335-2336, 2337-2338, 2339-2340, 2341-2342, 2343-2344, 2345-2346, 2347-2348, 2349-2350, 2351-2352, 2353-2354, 2355-2356, 2357-2358, 2359-2360, 2361-2362, 2363-2364, 2365-2366, 2367-2368, 2369-2370, 2371-2372, 2373-2374, 2375-2376, 2377-2378, 2379-2380, 2381-2382, 2383-2384, 2385-2386, 2387-2388, 2389-2390, 2391-2392, 2393-2394, 2395-2396, 2397-2398, 2399-2400, 2401-2402, 2403-2404, 2405-2406, 2407-2408, 2409-2410, 2411-2412, 2413-2414, 2415-2416, 2417-2418, 2419-2420, 2421-2422, 2423-2424, 2425-2426, 2427-2428, 2429-2430, 2431-2432, 2433-2434, 2435-2436, 2437-2438, 2439-2440, 2441-2442, 2443-2444, 2445-2446, 2447-2448, 2449-2450, 2451-2452, 2453-2454, 2455-2456, 2457-2458, 2459-2460, 2461-2462, 2463-2464, 2465-2466, 2467-2468, 2469-2470, 2471-2472, 2473-2474, 2475-2476, 2477-2478, 2479-2480, 2481-2482, 2483-2484, 2485-2486, 2487-2488, 2489-2490, 2491-2492, 2493-2494, 2495-2496, 2497-2498, 2499-2500, 2501-2502, 2503-2504, 2505-2506, 2507-2508, 2509-2510, 2511-2512, 2513-2514, 2515-2516, 2517-2518, 2519-2520, 2521-2522, 2523-2524, 2525-2526, 2527-2528, 2529-2530, 2531-2532, 2533-2534, 2535-2536, 2537-2538, 2539-2540, 2541-2542, 2543-2544, 2545-2546, 2547-2548, 2549-2550, 2551-2552, 2553-2554, 2555-2556, 2557-2558, 2559-2560, 2561-2562, 2563-2564, 2565-2566, 2567-2568, 2569-2570, 2571-2572, 2573-2574, 2575-2576, 2577-2578, 2579-2580, 2581-2582, 2583-2584, 2585-2586, 2587-2588, 2589-2590, 2591-2592, 2593-2594, 2595-2596, 2597-2598, 2599-2600, 2601-2602, 2603-2604, 2605-2606, 2607-2608, 2609-2610, 2611-2612, 2613-2614, 2615-2616, 2617-2618, 2619-2620, 2621-2622, 2623-2624, 2625-2626, 2627-2628, 2629-2630, 2631-2632, 2633-2634, 2635-2636, 2637-2638, 2639-2640, 2641-2642, 2643-2644, 2645-2646, 2647-2648, 2649-2650, 2651-2652, 2653-2654, 2655-2656, 2657-2658, 2659-2660, 2661-2662, 2663-2664, 2665-2666, 2667-2668, 2669-2670, 2671-2672, 2673-2674, 2675-2676, 2677-2678, 2679-2680, 2681-2682, 2683-2684, 2685-2686, 2687-2688, 2689-2690, 2691-2692, 2693-2694, 2695-2696, 2697-2698, 2699-2700, 2701-2702, 2703-2704, 2705-2706, 2707-2708, 2709-2710, 2711-2712, 2713-2714, 2715-2716, 2717-2

**Figure 44-B**

F = 3.245095E-01 SIGNIFICANCE OF F = 0.14251585E-01 \* X  
 R = 0.7733958E-01 SIGNIFICANCE OF A = 0.14251585E-01 \* X  
 U = 0.5031651E-01 SIGNIFICANCE OF U = 0.14251585E-01 \* X  
 N = 12 DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = 60% RH TEST CONDITIONS TEMP = 27 DEG C

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.



TEST 11.0150-11.0 MRS. BERRY, CIRCUIT 66 RELAX, 3 PERCENT, 477 DEG C, 100/SEC (002258T)

Figure 45



\*\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

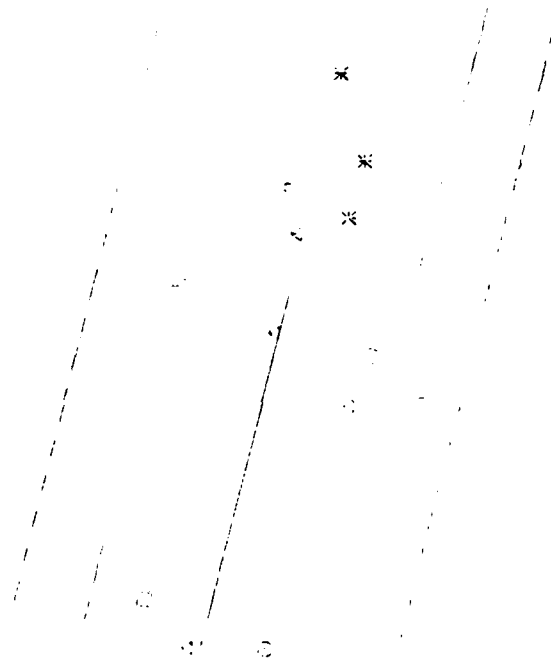
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+3.1800000E+02	+3.8505739E+01	+3.5700000E+02	+2.8000000E+02	+3.0930566E+02
228.0	3	+3.0133325E+02	+4.8747649E+01	+3.4700000E+02	+2.5000000E+02	+3.1569750E+02
251.0	6	+3.2832325E+02	+4.2145778E+01	+3.8300000E+02	+2.7000000E+02	+3.2549804E+02

STAGE II.DISSECTED MTRS.OUTER.STRESS RELAX.3 PERCENT.+77 DEG.100/SEC.<0022687>

[illegible]

## SYMBOLS

Motor	0022135	□
Motor	0022583	○
Motor	0022687	✕
Motor	0022788	△
90-90	Confidence	8
3-sigma	Limits	---



AGE AT TEST (YEARS)	15.00	20.00	24.00	28.00	32.00
12.00					

THE UNADJUSTED MEAN DIFFERENCE REACTION, 2 PERCENT, 0.71 MICRONS/SEC.

Figure 45-B

F = 0.362550E+02 SIGNIFICANCE OF F = 0.000000E+00  
 R = 0.651040E+02 SIGNIFICANCE OF R = 0.000000E+00  
 T = 0.000000E+00 SIGNIFICANCE OF T = 0.000000E+00  
 H = 0.000000E+00 SIGNIFICANCE OF H = 0.000000E+00  
 DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = AGE 140' RH  
 TEST CONDITIONS = TIME 77 DEG F

PERCENTAGE - STRESS RELAX MODULUS

UNIT OF MEASURE = PSI

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

\*  
 \*

AGE AT TEST (YEARS)

TEST INFORMATION: SPECIES RELAX, 3 PERCENT, 77 DEG, 1000/SEC, 0022537

Figure 46

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

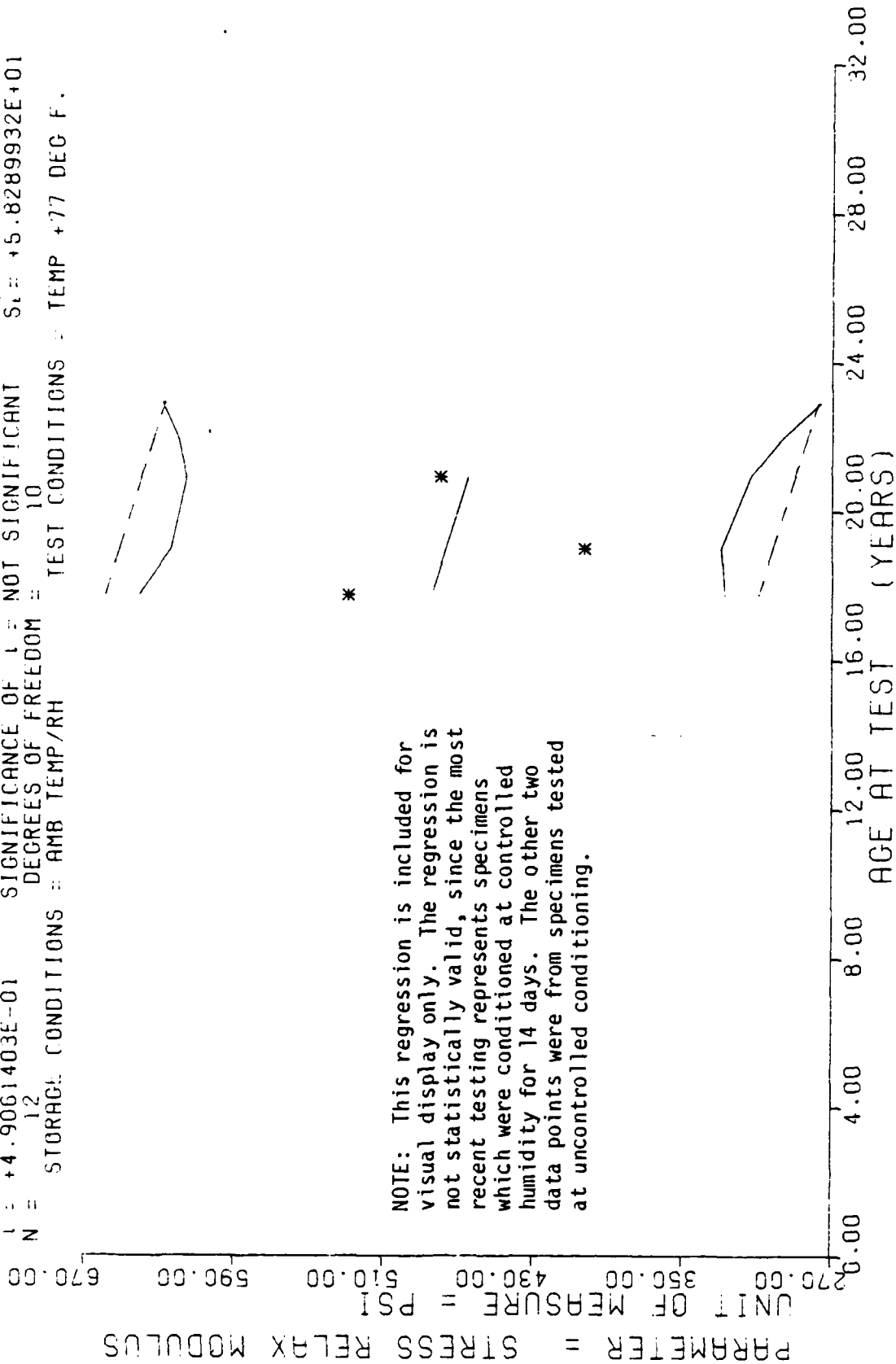
\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+2.4200000E+02	+3.0049958E+01	+2.7300000E+02	+2.1300000E+02	+2.3599862E+02
228.0	3	+2.2866666E+02	+3.5019042E+01	+2.6300000E+02	+1.9300000E+02	+2.3858193E+02
251.0	6	+2.4450000E+02	+3.2328006E+01	+2.9000000E+02	+2.0000000E+02	+2.4254302E+02

STAGE II, DISSECTED MTRS. OUTER, STRESS RELAX, 3 PERCENT, +77 DEG, 1000/SEC<0022687>



$Y = (( +5.9304091E+02 ) + ( -5.1130823E-01 ) * X )$   
 $F = +2.4070212E-01$  SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma = +5.6242171E+01$   
 $R = -1.5331162E-01$  SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_e = +1.0421802E+00$   
 $t = +4.9061403E-01$  SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_t = +5.8289932E+01$   
 $N = 12$  DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = TEMP +77 DEG F.



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

STAGE II, DISSECTED MTRS. INNER, STRESS RELAX, 3 PERCENT, +77 DEG, 10/SEC. <0022687>

Figure 47

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+5.2500000E+02	+6.3498031E+01	+5.7700000E+02	+4.5700000E+02	+4.8413208E+02
228.0	3	+4.0233325E+02	+8.0829037E+00	+4.0700000E+02	+3.9300000E+02	+4.7646240E+02
251.0	6	+4.7933325E+02	+1.5866219E+01	+4.9700000E+02	+4.4300000E+02	+4.6470239E+02

STAGE II.DISSECTED MTRS.INNER,STRESS RELAX.3 PERCENT ,+77 DEG.10/SEC.<0022687>

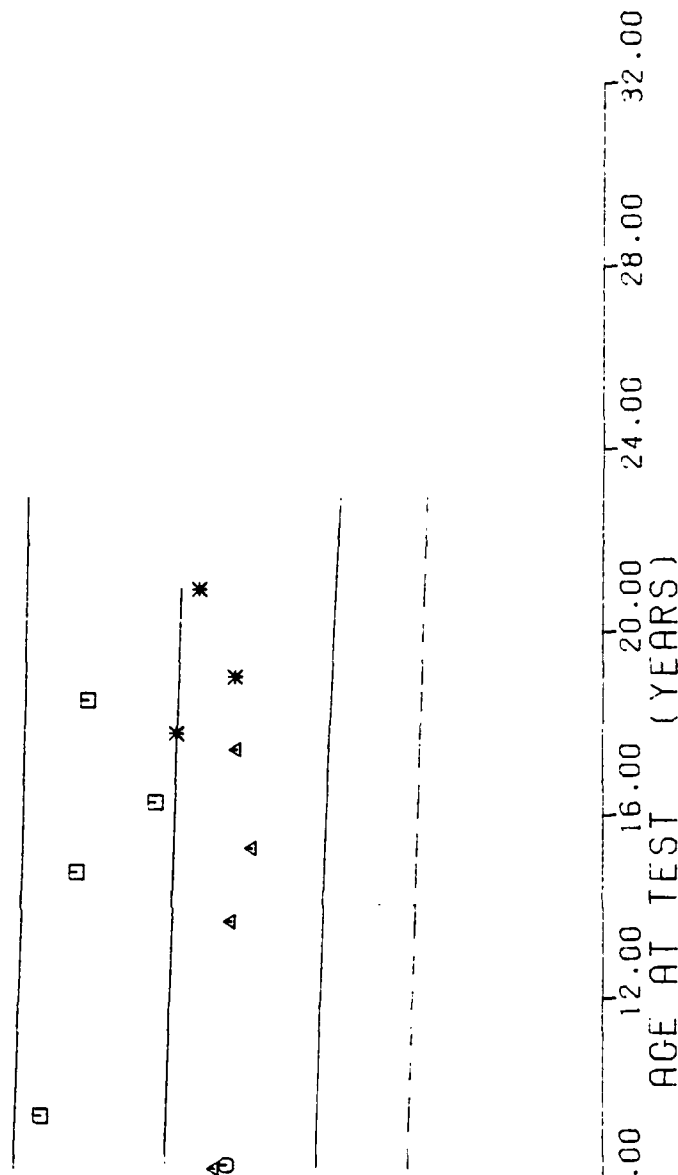
$\gamma = (1 + 5.7908754E+02) + (-2.4157823E-01) * X$   
 F = +4.3297531E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 R = -7.5264673E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 t = +6.5800859E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT  
 N = 78 DEGREES OF FREEDOM = 76  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = TEMP +77 DEG F.

PARAMETER = STRESS RELAX MODULUS

UNIT OF MEASURE = PSI \* 10<sup>1</sup>

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band —  
 3-sigma Limits ---

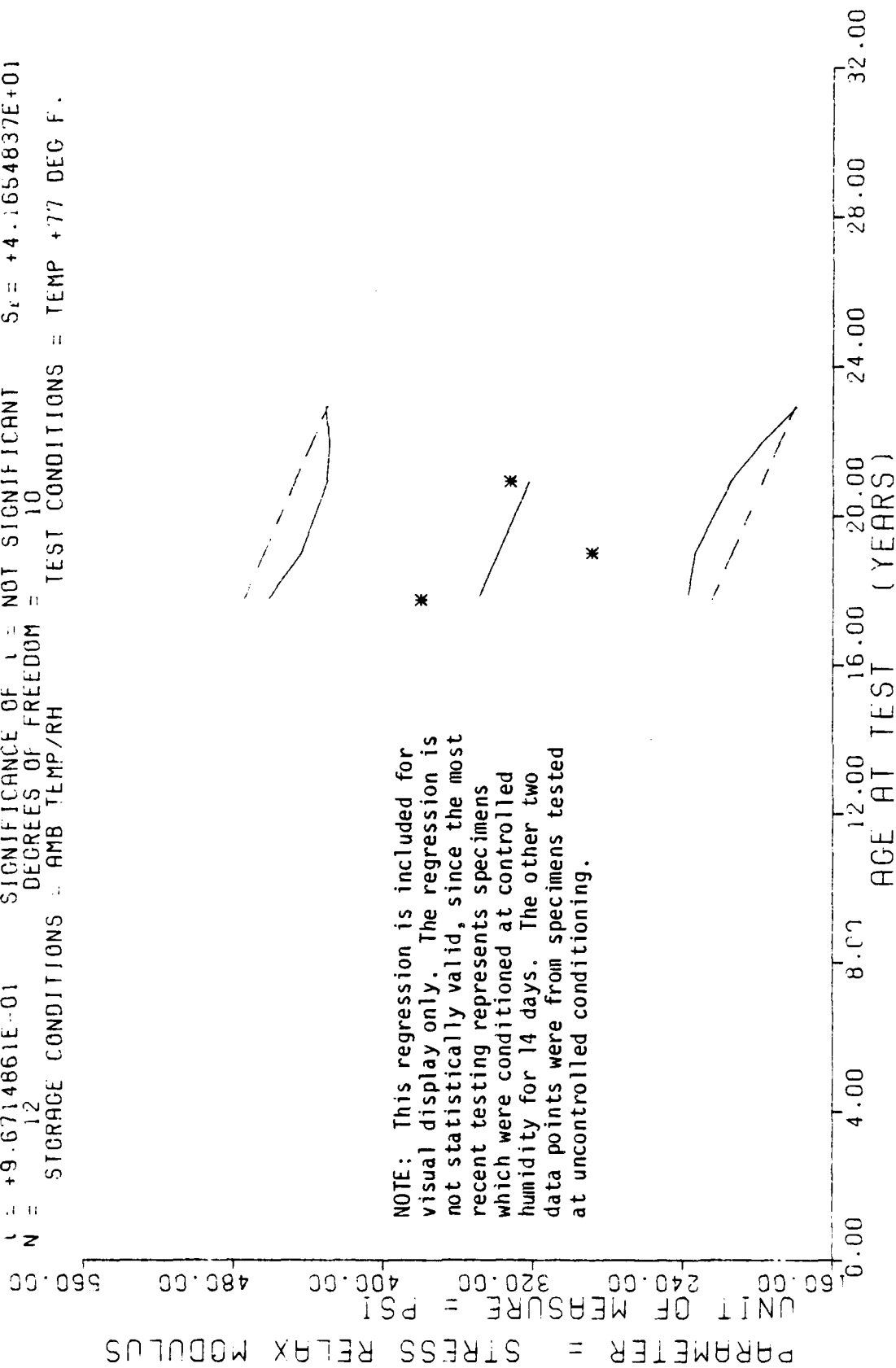


STAGE II, DISSECTED MRS. INNER, STRESS RELAXATION, 3 PERCENT, +77 DEG, 10/SEC.

Figure 47-B



$Y = ((+5.0305857E+02) + (-7.2029089E-01) * X)$   
 F = +9.3537643E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  $S_T = +4.1532298E+01$   
 R = -2.9246664E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_B = +7.4475720E-01$   
 U = +9.6714861E-01 SIGNIFICANCE OF U = NOT SIGNIFICANT  $S_C = +4.1654837E+01$   
 N = 12 DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = TEMP +77 DEG F.



STAGE 11, DISSECTED MTRS, INNER, STRESS RELAX, 3 PERCENT, +77 DEG, 50/SEC, <0022687>

Figure 48

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

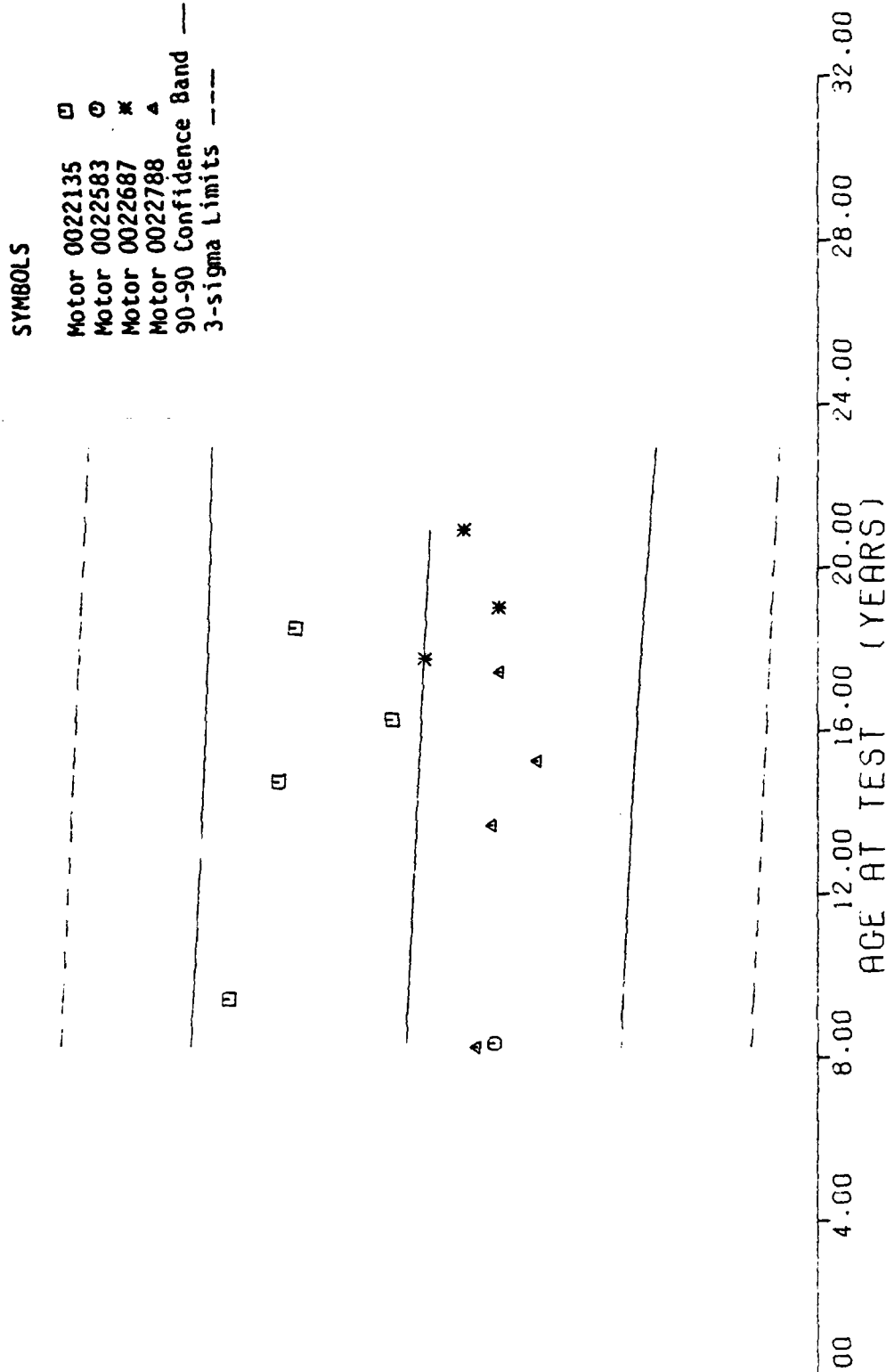
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+3.8000000E+02	+5.2716221E+01	+4.2700000E+02	+3.2300000E+02	+3.4963647E+02
228.0	3	+2.8866650E+02	+5.1316014E+00	+2.9300000E+02	+2.8300000E+02	+3.3883203E+02
251.0	6	+3.3216650E+02	+1.2937026E+01	+3.4300000E+02	+3.0700000E+02	+3.2226538E+02

STAGE II, DISSECTED MTRS, INNER, STRESS RELAX, 3 PERCENT, +77 DEG, 50/SEC, <0022687>

$Y = ((+4.2145415E+02) + (-1.9425288E-01) * X)$   
 $F = +4.4127156E-01$  SIGNIFICANCE OF F = NOT SIGNIFICANT  
 $R = -7.5978203E-02$  SIGNIFICANCE OF R = NOT SIGNIFICANT  
 $t = +6.6428274E-01$  SIGNIFICANCE OF t = NOT SIGNIFICANT  
 $N = 78$  DEGREES OF FREEDOM = 76  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = TEMP +77 DEG F.

PARAMETER = STRESS RELAX MODULUS

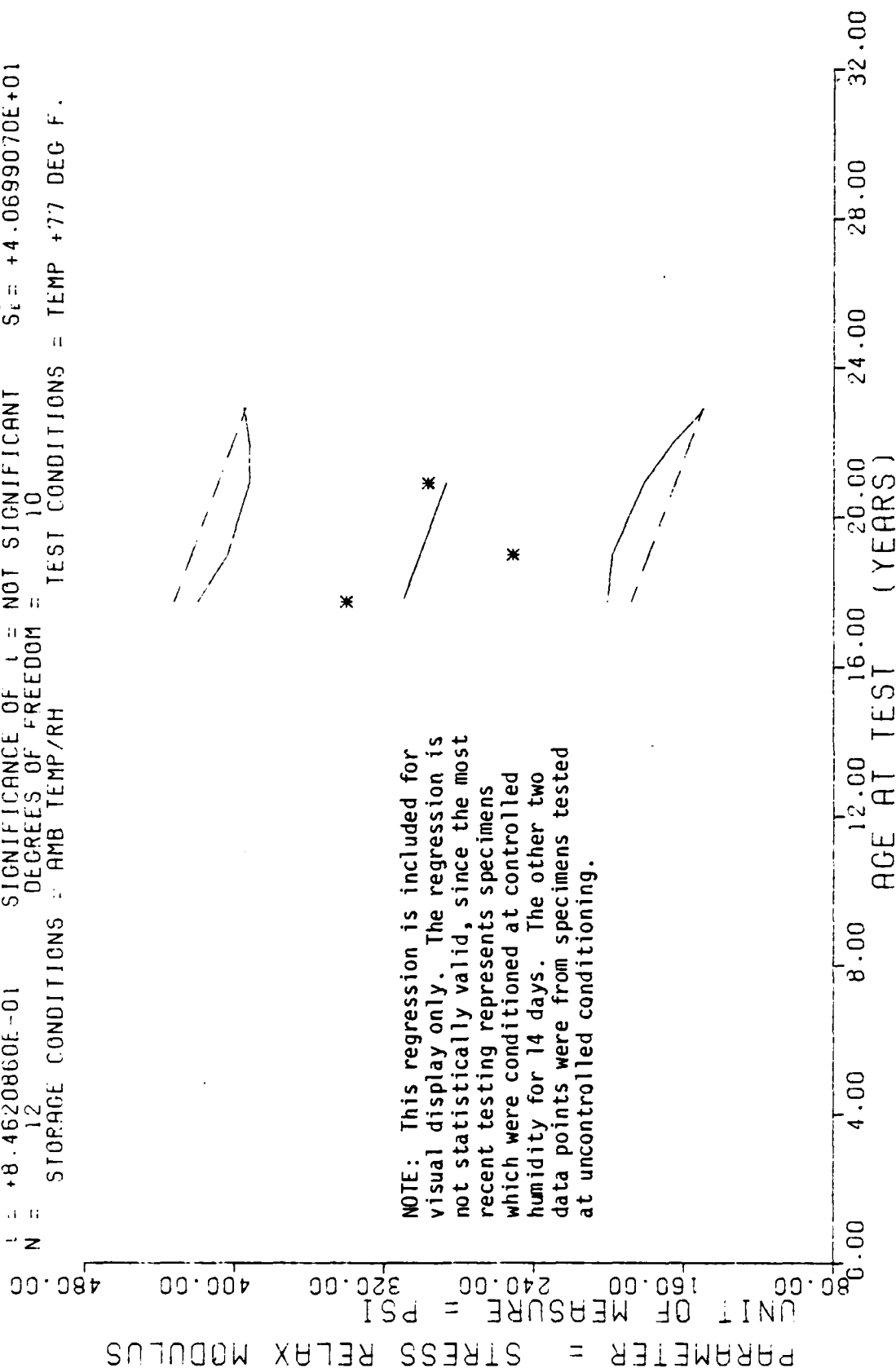
UNIT OF MEASURE = PSI \* 10<sup>1</sup>



STAGE II, DISSECTED MTRS. INNER, STRESS RELAXATION, 3 PERCENT, +77 DEG. 50/SEC.

Figure 48-B

$Y = (( +4.4141532E+02 ) + ( -6.1575961E-01 ) * X )$   
 F = +7.1606900E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma_y = +4.0170375E+01$   
 R = -2.5849948E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_e = +7.2766880E-01$   
 t = +8.4620860E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_e = +4.0699070E+01$   
 N = 12 DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = TEMP +77 DEG F.



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

STAGE II, DISSECTED MRS. INNER, STRESS RELAX, 3 PERCENT, +77 DEG, 100/SEC. <0022687>

Figure 49

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

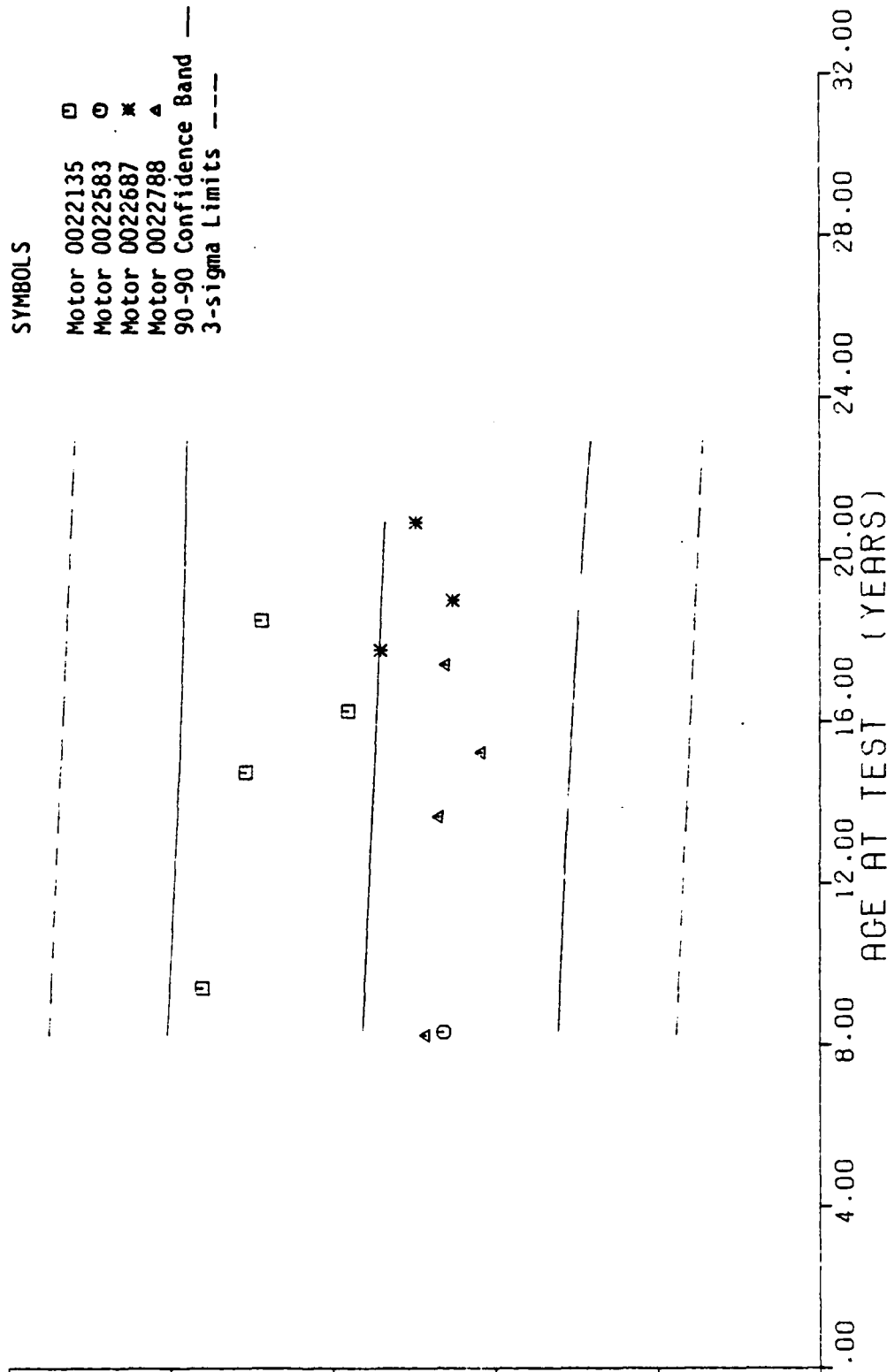
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+3.4033325E+02	+5.03332229E+01	+3.8700000E+02	+2.8700000E+02	+3.1025830E+02
228.0	3	+2.5133332E+02	+5.1316014E+00	+2.5700000E+02	+2.4700000E+02	+3.0102197E+02
251.0	6	+2.9666650E+02	+1.2225656E+01	+3.0700000E+02	+2.7300000E+02	+2.8685961E+02

STAGE II.DISSECTED MTRS.INNER,STRESS RELAX.3 PERCENT.+77 DEG.100/SEC.<0022687>

$Y = ((+3.8125515E+02) + (-1.8657633E-01) * X)$   
 $F = +4.8460775E-01$  SIGNIFICANCE OF F = NOT SIGNIFICANT  
 $R = -7.9599100E-02$  SIGNIFICANCE OF R = NOT SIGNIFICANT  
 $t = +6.9613774E-01$  SIGNIFICANCE OF t = NOT SIGNIFICANT  
 $N = 78$  DEGREES OF FREEDOM = 76  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = TEMP +77 DEG F.

PARAMETER = STRESS RELAX MODULUS

UNIT OF MEASURE = PSI \* 10<sup>1</sup>



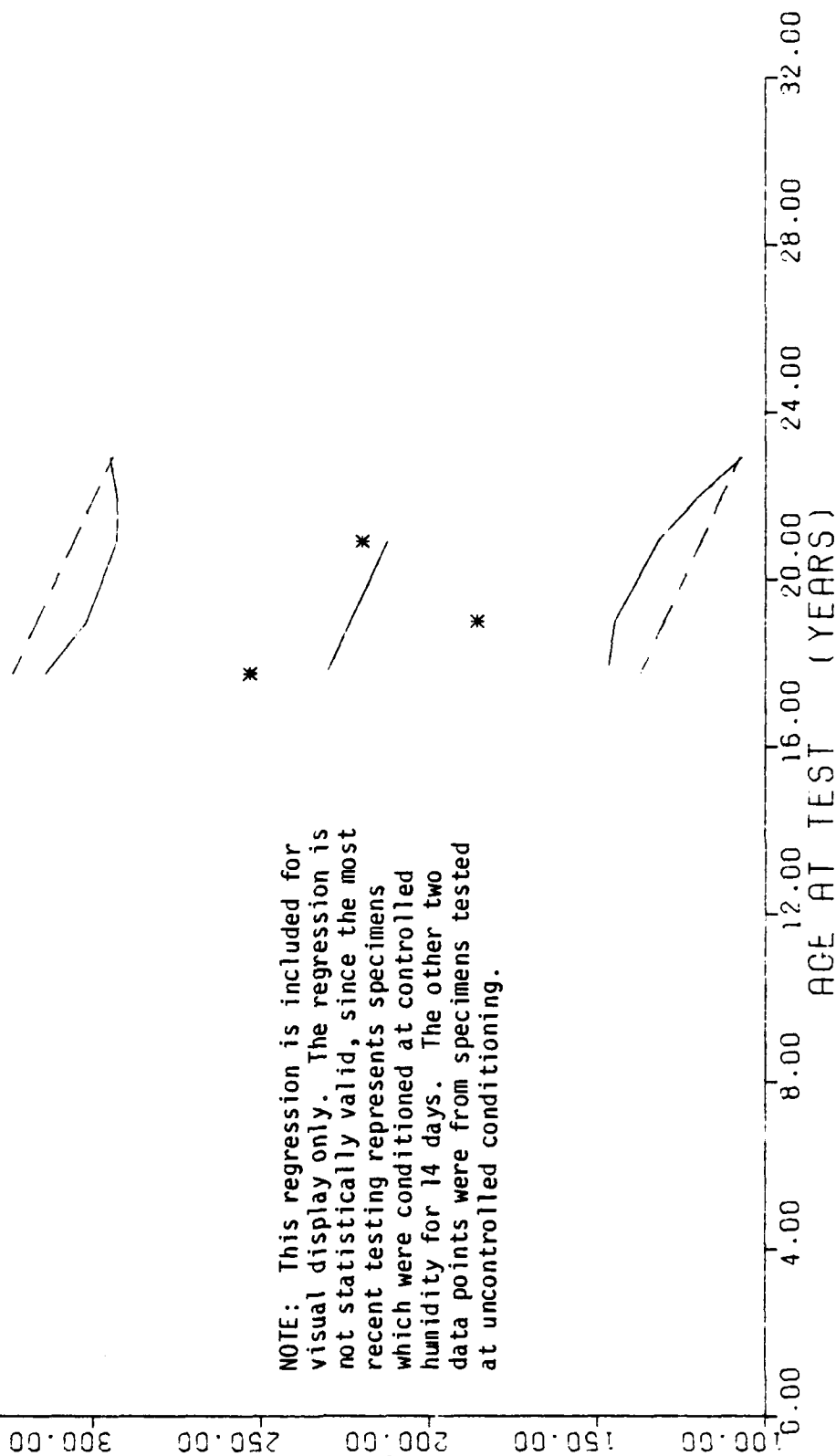
STAGE II DISSECTED MTRS. INNER STRESS RELAXATION .3 PERCENT .+77 DEG. 100/SEC.

Figure 49-B

$Y = (( +3.3210620E+02 ) + ( -4.7694397E-01 ) * X )$   
 F = +7.3519531E-01      SIGNIFICANCE OF F = NOT SIGNIFICANT       $\sigma^2 = +3.0734444E+01$   
 R = -2.6169558E-01      SIGNIFICANCE OF R = NOT SIGNIFICANT       $S_e = +5.5624485E-01$   
 t = +8.5743531E-01      SIGNIFICANCE OF t = NOT SIGNIFICANT       $S_e = +3.11111197E+01$   
 N = 12  
 STORAGE CONDITIONS = AMB TEMP/RH      TEST CONDITIONS = TEMP +77 DEG F.

PARAMETER = STRESS RELAX MODULUS

UNIT OF MEASURE = PSI



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

STAGE II, DISSECTED MRS. INNER, STRESS RELAX, 3 PERCENT, +77 DEG. 1000/SEC<0022687>

Figure 50

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+2.5333332E+02	+3.8630730E+01	+2.9000000E+02	+2.1300000E+02	+2.3051713E+02
228.0	3	+1.8566665E+02	+2.3054010E+00	+1.8700000E+02	+1.8300000E+02	+2.2336297E+02
251.0	6	+2.1983332E+02	+1.0264826E+01	+2.3000000E+02	+2.0000000E+02	+2.1239326E+02

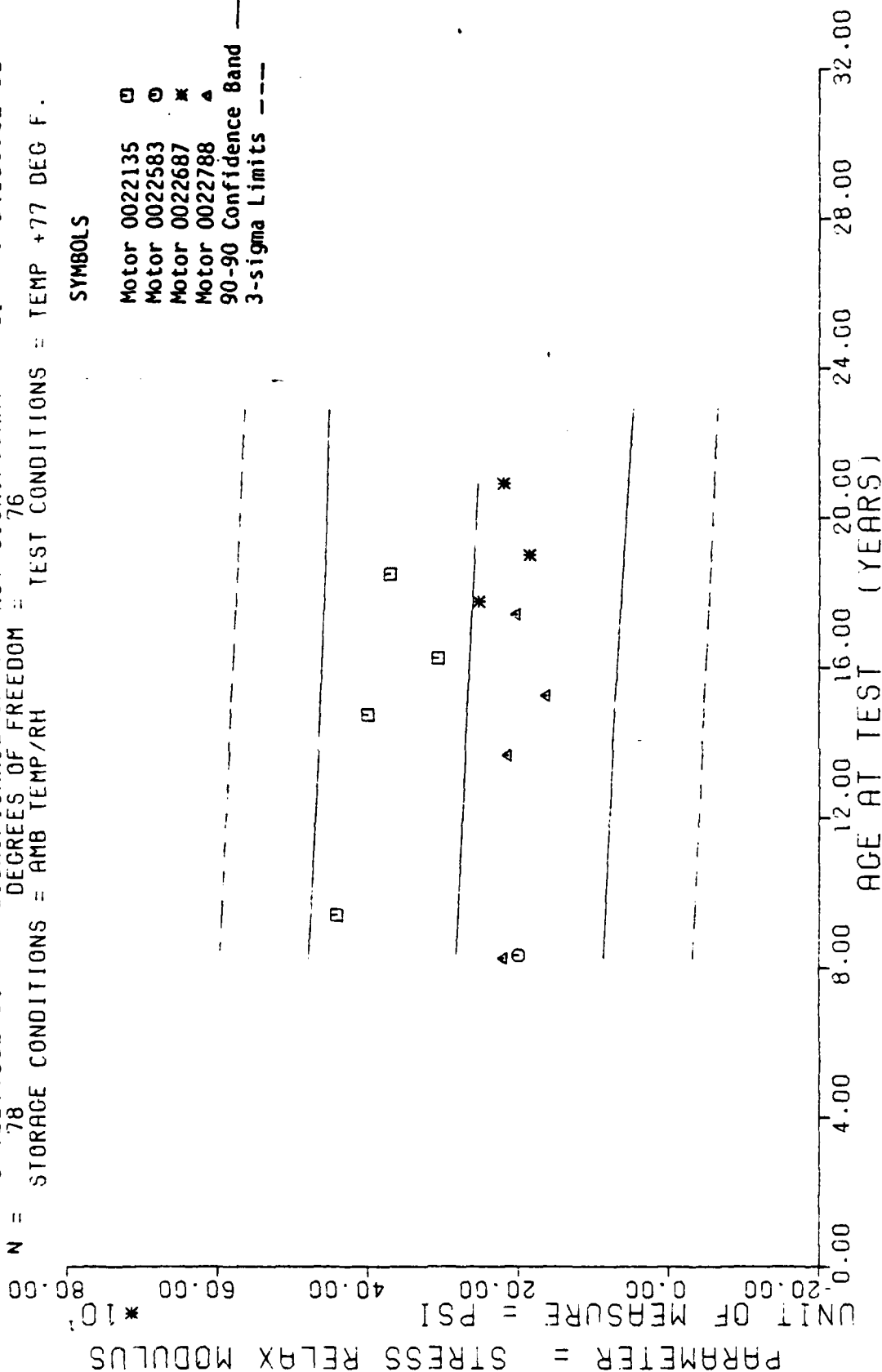
STAGE 11, DISSECTED MTRS. INNER, STRESS RELAX, 3 PERCENT, +77 DEG, 1000/SEC<0022687>



$Y = ((+3.0180900E+02) + (-1.9040919E-01) * X)$   
 F = +7.6086732E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma_y = +1.0467018E+02$   
 R = -9.9559917E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_e = +2.1828980E-01$   
 t = +8.7227708E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_c = +1.0483309E+02$   
 N = 78 DEGREES OF FREEDOM = 76  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = TEMP +77 DEG F.

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



STAGE II, DISSECTED MTRS, INNER, STRESS RELAXATION, 3 PERCENT, +77 DEG, 1000/SEC.

Figure 50-B

Y = (0.45 333555E-05) (1.43 1020100E-09) (X)  
 F = +1 3111566E-02 SIGNIFICANCE OF F = NOT SIGNIFICANT S.E. = +4.3223670E-06  
 R = +3 3112455E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S.E. = +7.9306076E-06  
 T = +1 1476789E-01 SIGNIFICANCE OF T = NOT SIGNIFICANT S.E. = +4.4963952E-06  
 N = 14 DEGREES OF FREEDOM = 12  
 STORAGE CONDITIONS = 100% RH TEST CONDITIONS = 5 DEGREES C/MIN

PARAMETER = TOLR BELOW TIG  
 UNIT OF MEASURE = IN/IN/DEG C  
 \* 10<sup>-7</sup>  
 0.90  
 0.72  
 0.54  
 0.36  
 0.18  
 0.00

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00  
 AGE AT TEST (YEARS)

STAGE II DISSEC MRS. OUTER. THERMAL COEFF OF LINEAR EXPAN BELOW 10 ~0022587>

Figure 51

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

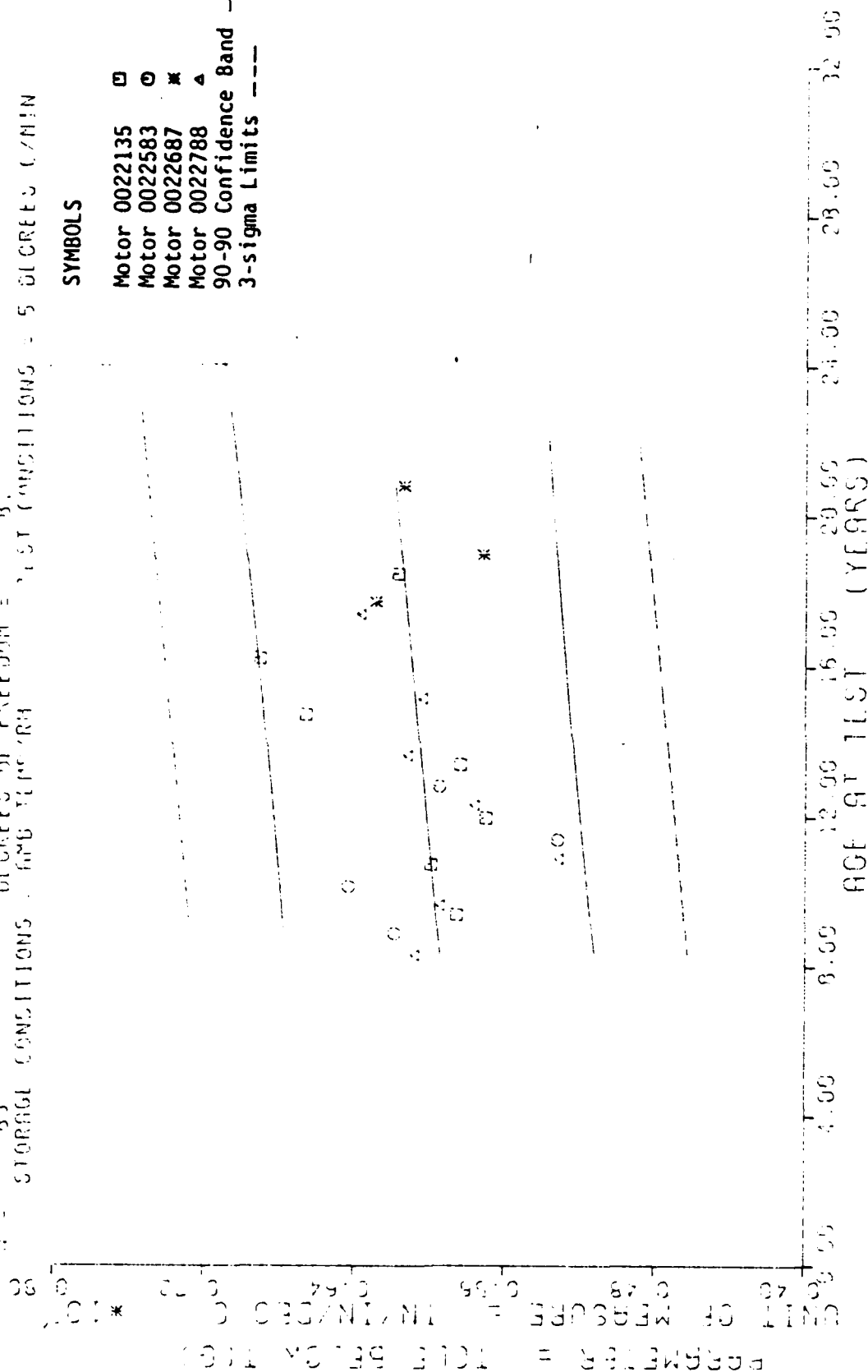
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+6.286660E-05	+1.7779052E-06	+6.4899599E-05	+6.1599988E-05	+6.0278311E-05
228.0	4	+5.7145984E-05	+5.7673593E-06	+6.3399587E-05	+4.9599999E-05	+6.0414837E-05
250.0	7	+6.1371363E-05	+3.4107091E-06	+6.5499589E-05	+5.5299999E-05	+6.0615086E-05

STAGE II DISSEC MTRS. OUTER, THERMAL COEFF OF LINEAR EXPAN BELOW TG <0022687>

Y = 11 45 2829628E-09  
 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 R = 41 7650345E-01  
 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 T = 41 5137132E-06  
 SIGNIFICANCE OF T = NOT SIGNIFICANT  
 D.F. = 93  
 DEGREES OF FREEDOM = 93  
 STORAGE CONDITIONS - 6MB HYP'RH  
 TEST CONDITIONS - 5 DEGREES C/MIN

# SYMBOLS

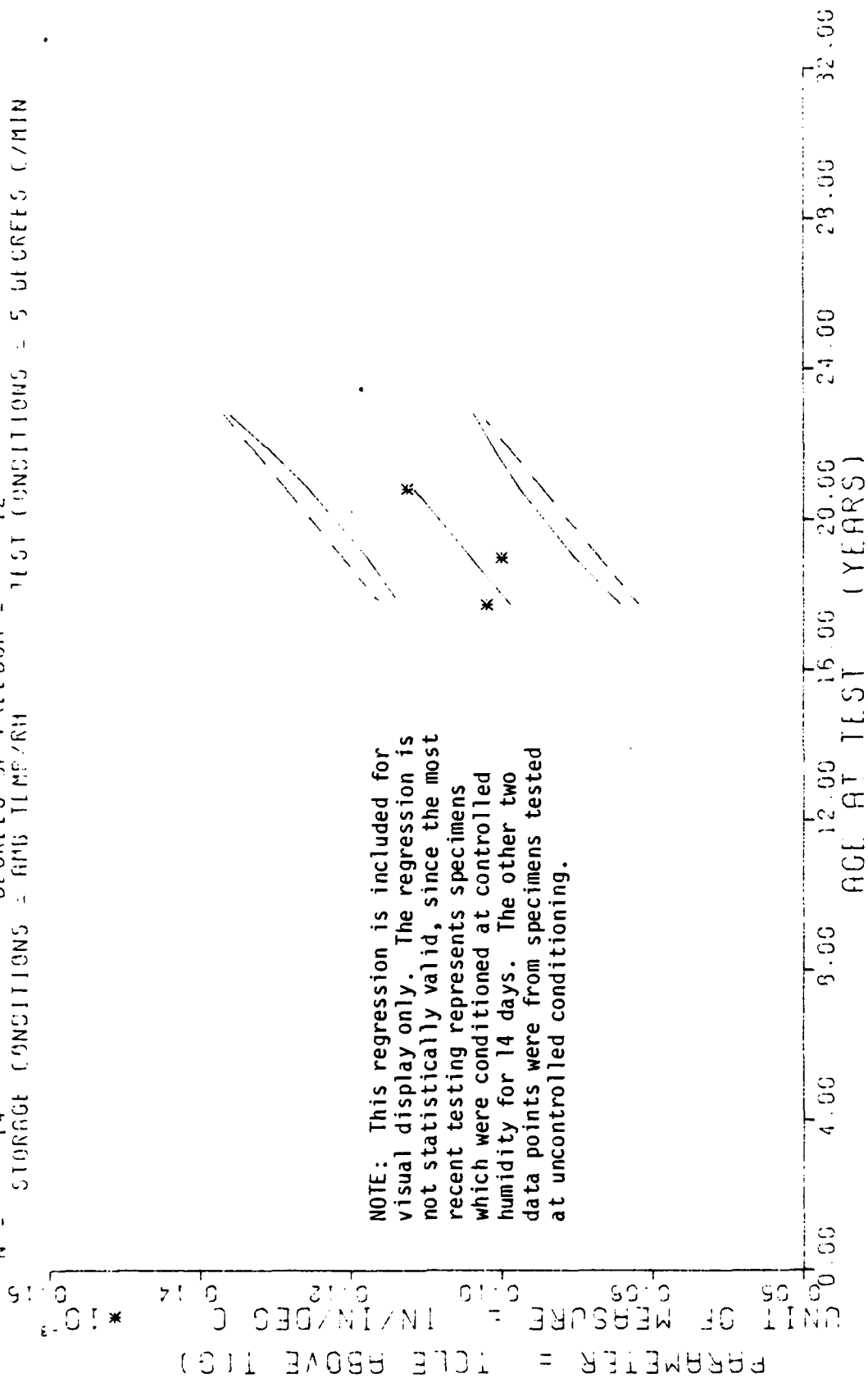
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



STAGE II DISCOUNT MRS. OUTLIER THERMAL COEFFICIENT OF LINEAR EXPANSION BELOW TC

Figure 51-B

$Y = (1 + 2.5278307E-05) X + (3.4528788E-07) X^2$   
 F = +1.1922633E+01 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +7.0670344E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +3.4601590E+00 SIGNIFICANCE OF T = SIGNIFICANT  
 N = 14 DEGREES OF FREEDOM = 12  
 STORAGE CONDITIONS = RMS TEMP/RH TEST CONDITIONS = 5 DEGREES C/MIN



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represented specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

STAGE II DISSEC MRS. OUTER. THERMAL COEFF OF LINEAR EXPAN ABOVE TC <0022687>

Figure 52

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	+1.0195991E-04	+3.1988033E-06	+1.0449599E-04	+9.8399992E-05	+9.8825214E-05
228.0	4	+9.9999946E-05	+2.9628903E-06	+1.0179599E-04	+9.6699994E-05	+1.0400453E-04
250.0	7	+1.1252847E-04	+6.2854267E-06	+1.2319599E-04	+1.0329998E-04	+1.1160086E-04

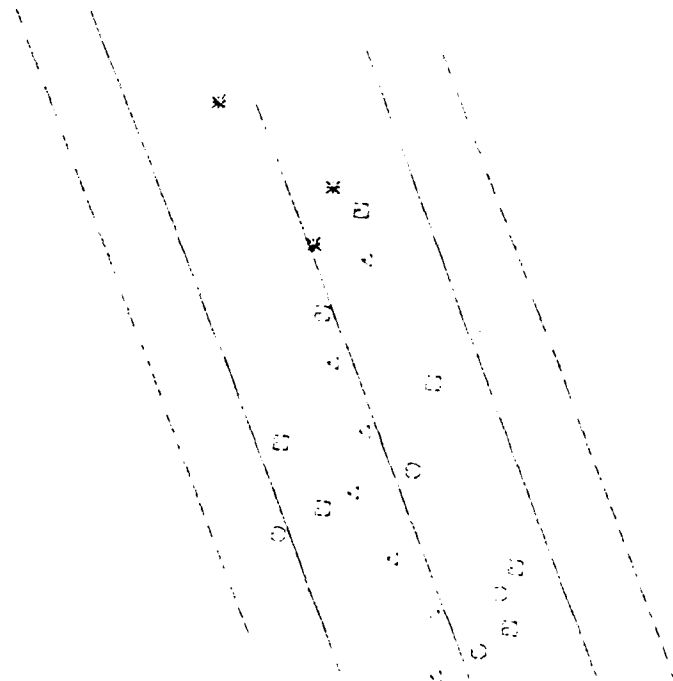
STAGE II DISSEC MRS.CUTER.THERMAL COEFF OF LINEAR EXPAN ABOVE TG <0022687>

Y = 10 06 640668E-05  
 SIGNIFICANCE OF F = 5023102E-07 (X)  
 R = 10 03 11368E-01  
 SIGNIFICANCE OF K = 5023102E-07  
 T = 10 03 2555E-06  
 SIGNIFICANCE OF T = 5023102E-07  
 DEGREES OF FREEDOM = 93  
 STORAGE CONDITIONS - 600 HOURS  
 TEST CONDITIONS - 5 DEGREES C/MIN

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ---

PARAMETER = TOL ABOVE TIG  
 UNIT OF MEASURE = IN/IN/DEG C \* 10<sup>-5</sup>



STAGE II DISSECTED MRS. OUTER THERMAL COEFFICIENT OF LINEAR EXPANSION ABOVE TC

Figure 52-B

F = +1.8593178E-01  
 R = +1.2340017E-01  
 U = +4.3106211E-01  
 H = 14  
 STORAGE CONDITIONS = 60% RH  
 Y = (1 - 6.1952778E-01) + (1 + 2.0399546E-02) \* X  
 SIGNIFICANCE OF F = NOT SIGNIFICANT  
 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 SIGNIFICANCE OF U = NOT SIGNIFICANT  
 SIGNIFICANCE OF H = NOT SIGNIFICANT  
 DEGREES OF FREEDOM = 12  
 TEST CONDITIONS = 5 DEGREES C/MIN

PARAMETER = TOL R1 CLASS POINT

UNIT OF MEASURE = IN/IN/DEG C

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represented specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

AGE AT TEST (YEARS)

STAGE II DISSLO MRS. OUTER THERMAL COEFF OF LINEAR EXPAN CP <0022587>

Figure 53



\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
213.0	3	-5.5666656E+01	+2.0816659E+00	-5.4000000E+01	-5.8000000E+01	-5.7607666E+01
228.0	4	-5.5750000E+01	+1.7078251E+00	-5.8000000E+01	-6.2000000E+01	-5.7301681E+01
250.0	7	-5.6285705E+01	+2.2886885E+00	-5.3000000E+01	-6.0000000E+01	-5.6852890E+01

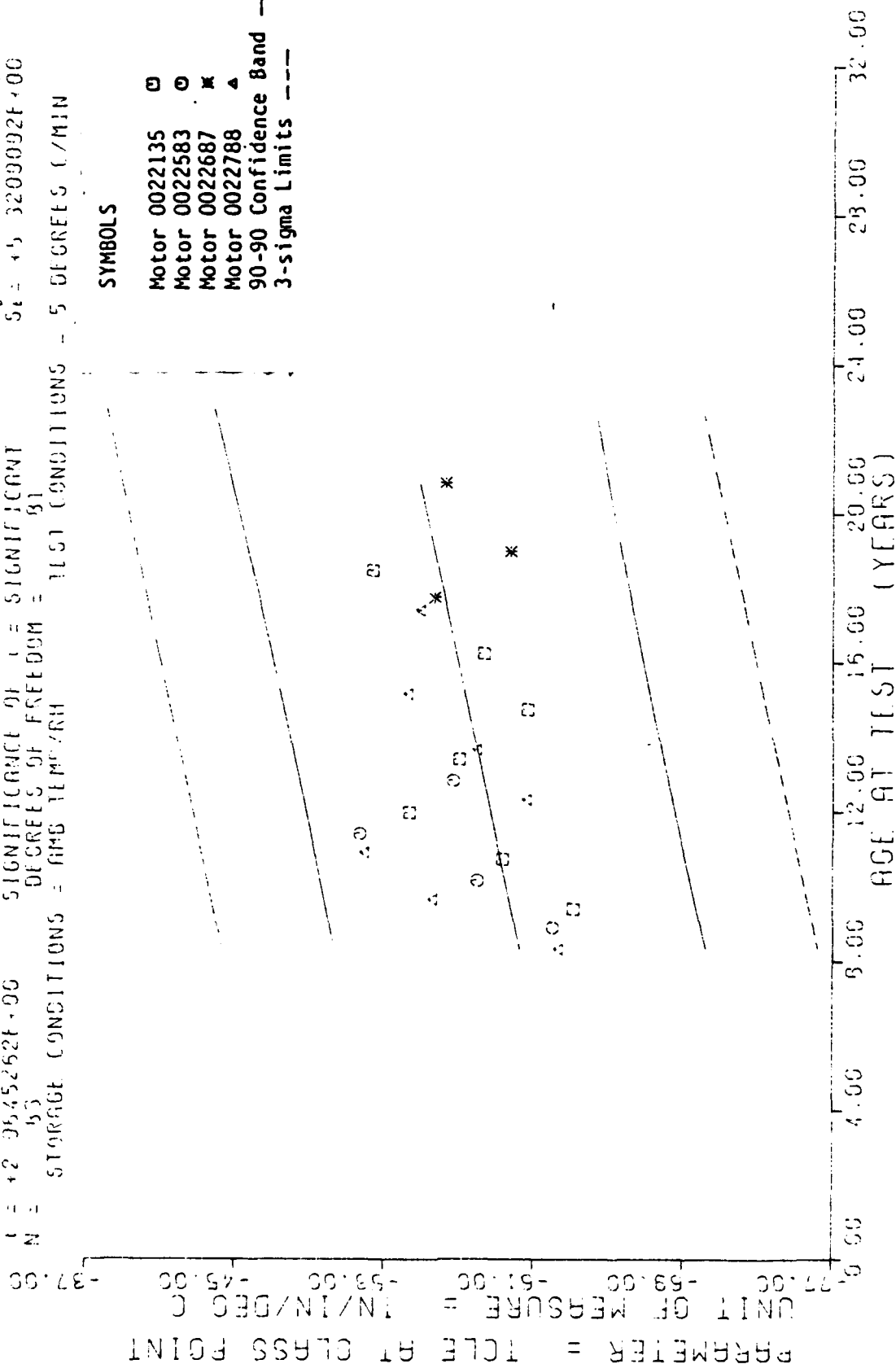
STAGE II DISSEC MTRS. OUTER, THERMAL COEFF OF LINEAR EXPAN GP <0022687>

Figure 53-A

Y = 11 - 6 3825511E+01 ) + ( +3 5715526E-02 ) \* X )  
 F = +3 7864150E+00 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +3 1285647E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +2 0545262E+00 SIGNIFICANCE OF T = SIGNIFICANT  
 N = 53 DEGREES OF FREEDOM = 51  
 STORAGE CONDITIONS = RMS TEMP/RH TEST CONDITIONS = 5 DEGREES C/MIN

# SYMBOLS

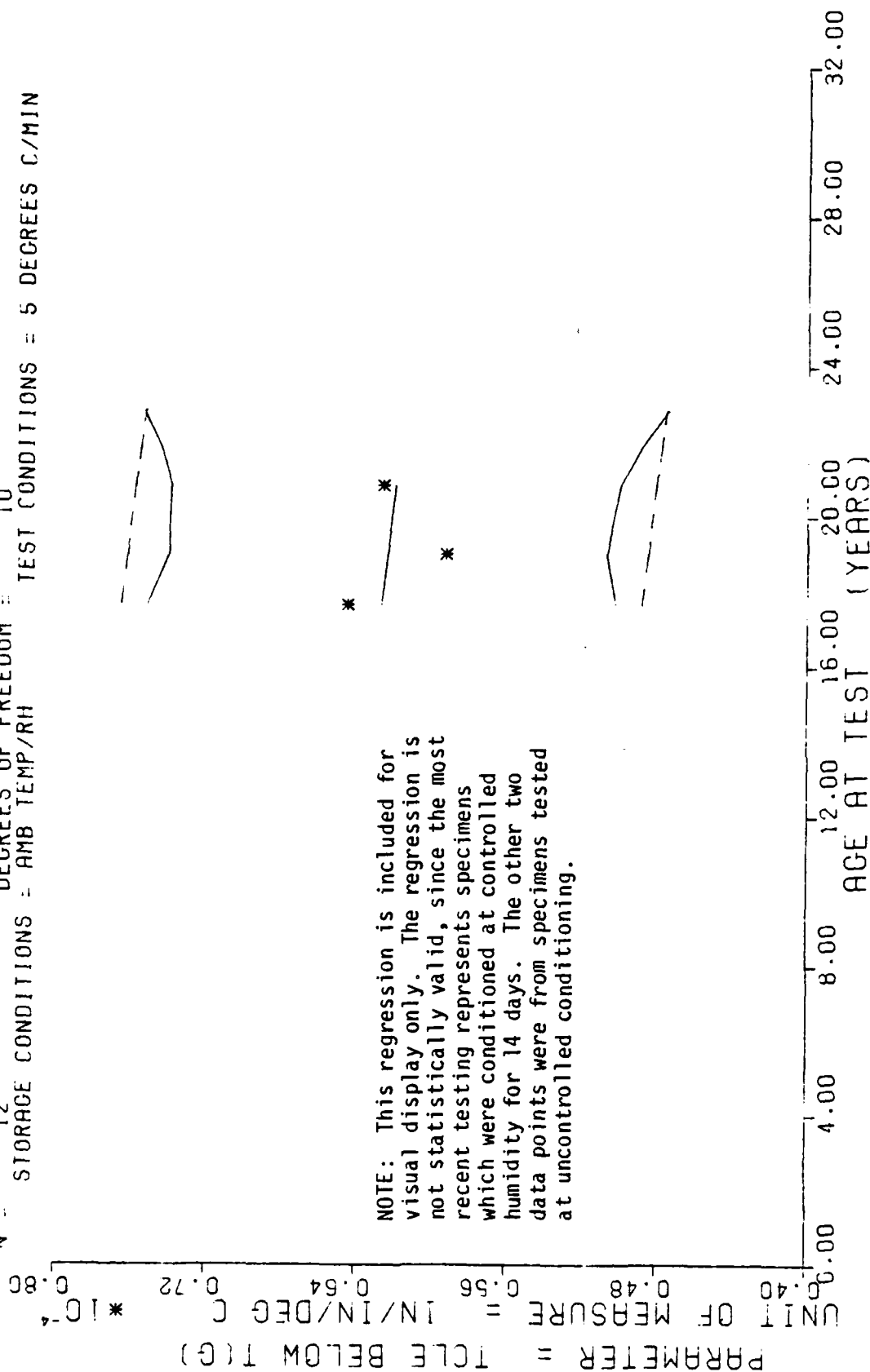
Motor 0022135  $\square$   
 Motor 0022583  $\circ$   
 Motor 0022687 \*  
 Motor 0022788  $\Delta$   
 90-90 Confidence Band ---  
 3-sigma Limits ---



STAGE II DISSIC M'RS. OUTER THERMAL COEFF OF LINEAR EXPAN CP <0022657>

Figure 53-B

$Y = (( +6.7076070E-05 ) + ( -2.0784695E-08 ) * X )$   
 F = +6.2520813E-02 SIGNIFICANCE OF F = NOT SIGNIFICANT  $S_y = +4.4151512E-06$   
 R = -7.8824080E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_b = +8.3124940E-08$   
 U = +2.5004162E-01 SIGNIFICANCE OF U = NOT SIGNIFICANT  $S_e = +4.6162416E-06$   
 N = 12 DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 5 DEGREES C/MIN



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represented specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

STAGE II DISSEC MTRS, INNER, THERMAL COEFF OF LINEAR EXPAN BELOW TG <0022687>

Figure 54

\*\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

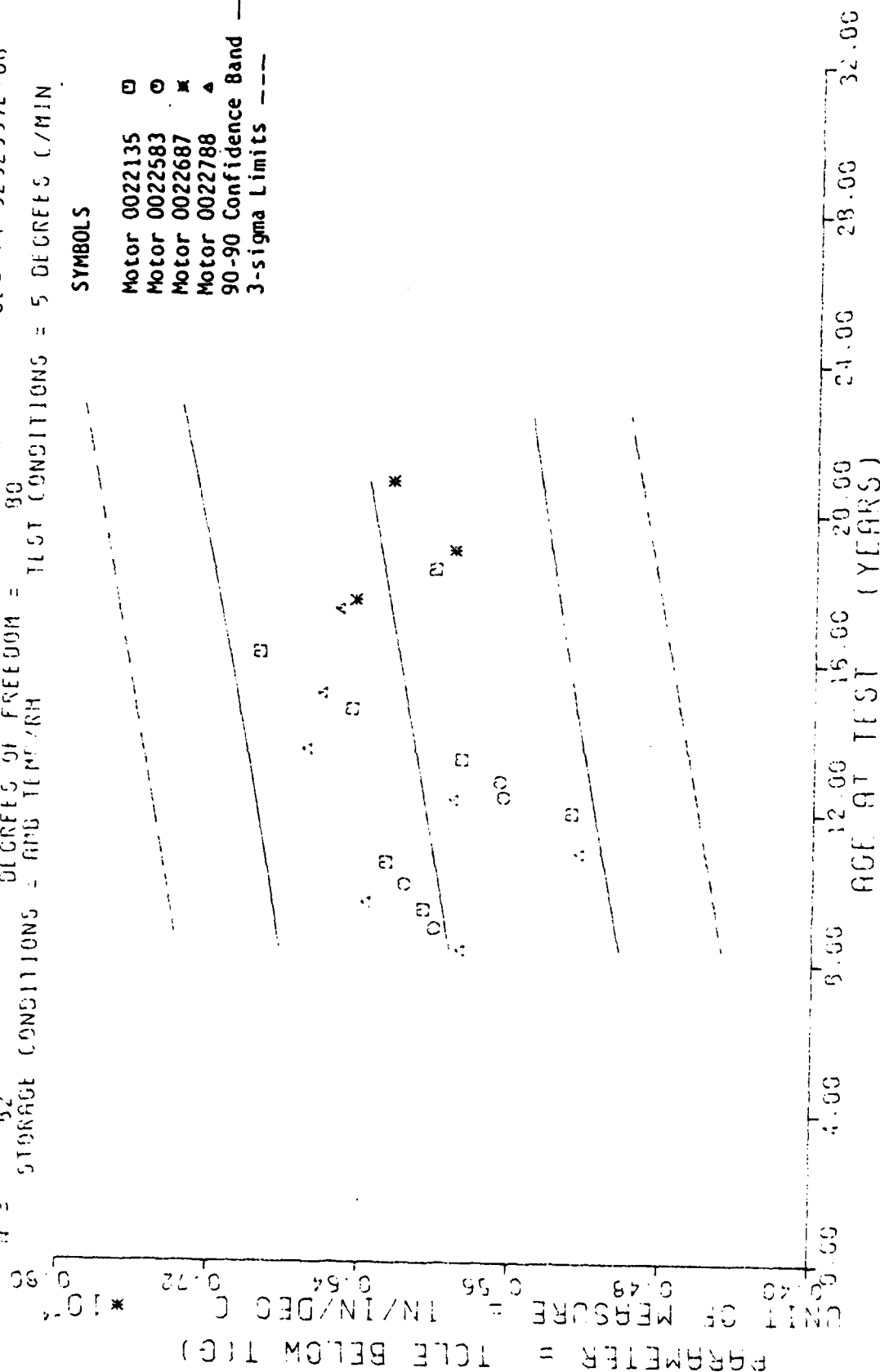
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	3	+6.446657E-05	+4.2712507E-06	+6.9195588E-05	+6.0899998E-05	+6.2669700E-05
228.0	3	+5.9233323E-05	+2.6649306E-06	+6.1195585E-05	+5.6199991E-05	+6.2337145E-05
250.0	6	+6.2533305E-05	+4.9246900E-06	+7.1095588E-05	+5.7699988E-05	+6.1879894E-05

STAGE II DISSEC MRS. INNER, THERMAL COEFF OF LINEAR EXPAN BELOW YG <0022687>

Y = 11 +5.5234037E-05 1 1 +3.0274275E-08 1 \* X)  
 F = +7.1266557E+00 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +2.8500059E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +2.5605798E+00 SIGNIFICANCE OF T = SIGNIFICANT  
 N = 52 DEGREES OF FREEDOM = 90  
 STORAGE CONDITIONS = 60% TEMPER/RH TEST CONDITIONS = 5 DEGREES C/MIN

# SYMBOLS

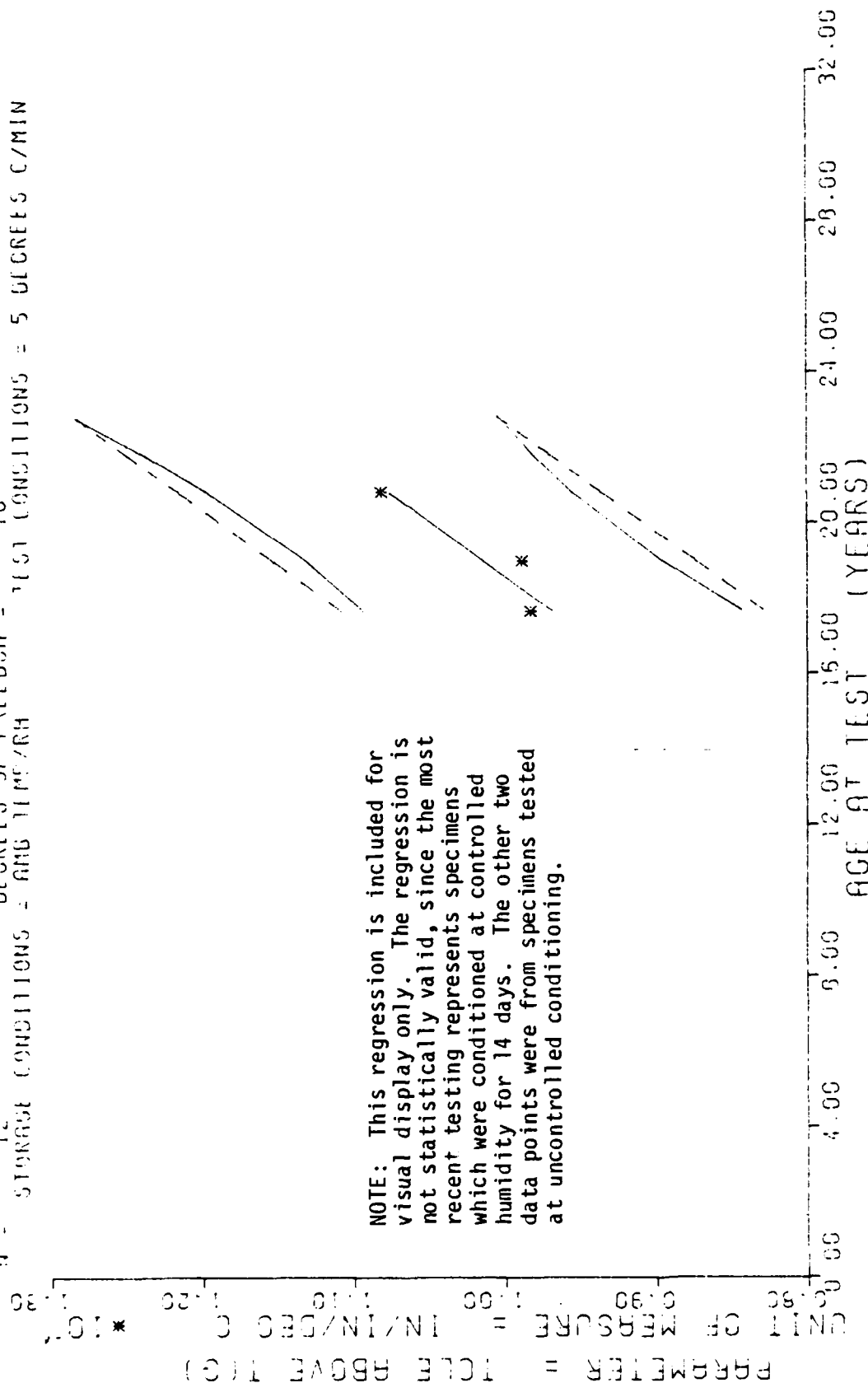
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



STAGE II DISSECTED MRS. INNER THERMAL COEFFICIENT OF LINEAR EXPANSION BELOW TC

Figure 54-B

Y = (1 +3 6756713E-05 ) ( +2.8336575E-07 ) ( \* X )  
 F = +1.1469482E+01 SIGNIFICANCE OF F = SIGNIFICANT G = +6 4927173E-06  
 R = +7.3077168E-01 SIGNIFICANCE OF R = SIGNIFICANT S = +9.3703941E-08  
 T = +3.3953335E+00 SIGNIFICANCE OF T = SIGNIFICANT SE = +4 6483957E-06  
 N = 12 DEGREES OF FREEDOM = 10  
 STORAGE CONDITIONS = 5 DEGREES C/MIN  
 TEST CONDITIONS = 5 DEGREES C/MIN



NOTE: This regression is included for  
 visual display only. The regression is  
 not statistically valid, since the most  
 recent testing represented specimens  
 which were conditioned at controlled  
 humidity for 14 days. The other two  
 data points were from specimens tested  
 at uncontrolled conditioning.

STAGE II DISSEC MTRS. INNER. THERMAL COEFF OF LINEAR EXPAN ABOVE T0 <0022687>

Figure 55

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

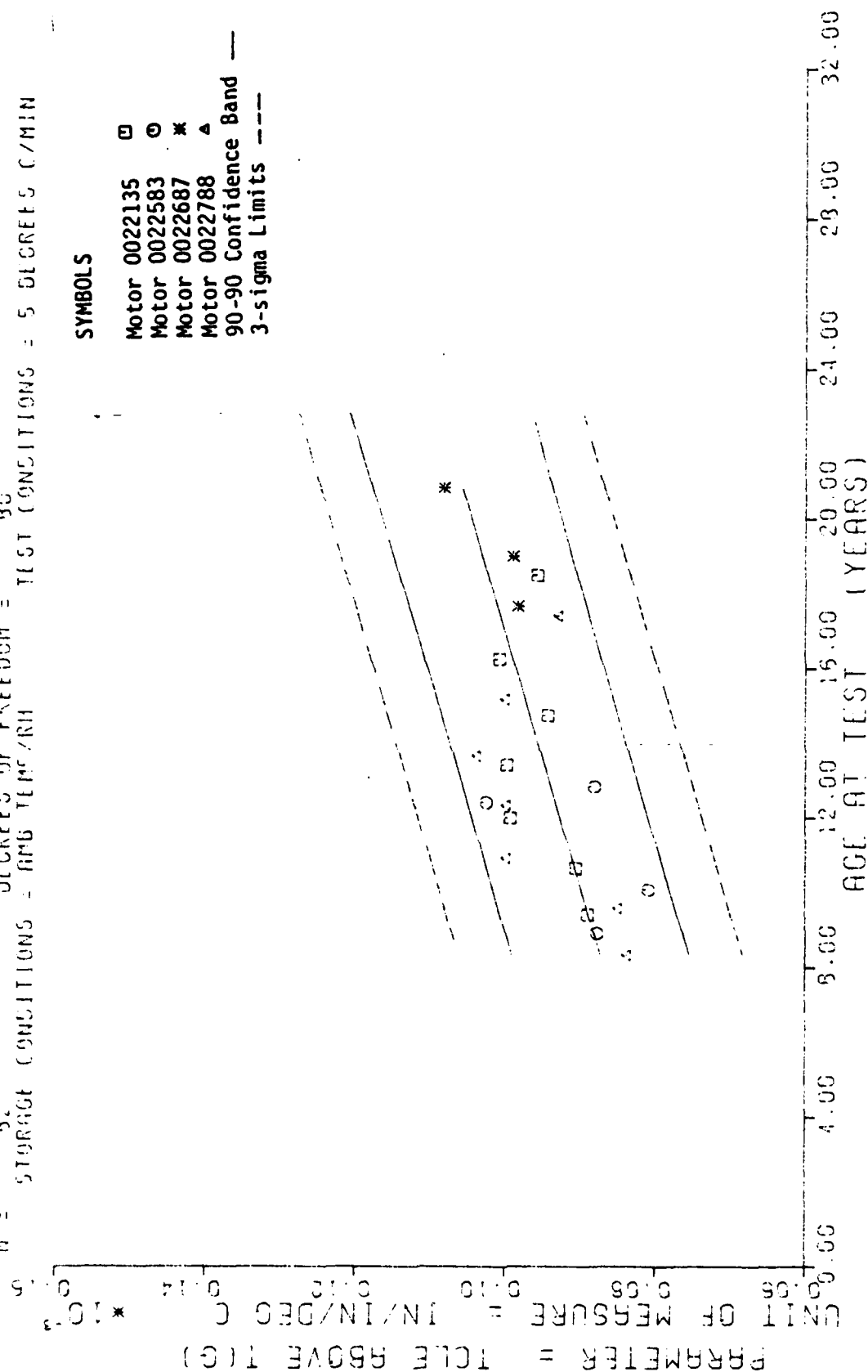
AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	3	+5.8266638E-05	+2.9273918E-06	+1.0149558E-04	+9.5799987E-05	+9.6824252E-05
228.0	3	+9.8866643E-05	+7.3230017E-06	+1.0649599E-04	+9.1899986E-05	+1.0135810E-04
250.0	6	+1.0811656E-04	+3.6128091E-06	+1.1169559E-04	+1.0279999E-04	+1.0759214E-04

STAGE II DISSEC MTRS. INNER. THERMAL COEFF OF LINEAR EXPAN ABOVE TG <0022687>

F = +6.8440396E-01  
 R = +6.7201628E-01  
 T = +8.2728705E-06  
 N = 52  
 STORAGE CONDITIONS = 85 DEGREES C / MIN  
 TEST CONDITIONS = 5 DEGREES C / MIN  
 Y = 11 +7.4371545E-05 J + (+1.2271889E-07) \* X1  
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF R = SIGNIFICANT  
 SIGNIFICANCE OF T = SIGNIFICANT  
 DEGREES OF FREEDOM = 86  
 G = +8.5408461E-06  
 S = +1.4833895E-06  
 St = +6.3090993E-06

# SYMBOLS

Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



STAGE II DISSOLVED MRS. INNER THERMAL COEFFICIENT OF LINEAR EXPANSION ABOVE TC



F = +2.2365467E-02      SIGNIFICANCE OF F = -4.8639132E-03      J = X  
 R = +5.4111441E-02      SIGNIFICANCE OF R = NOT SIGNIFICANT      G = +1.5050420E+00  
 T = +1.7136547E-01      SIGNIFICANCE OF T = NOT SIGNIFICANT      S = +2.8392525E-02  
 N = 12      DEGREES OF FREEDOM = 10      S = +1.5761887E+00  
 STORAGE CONDITIONS = 5 DEGREES C/MIN  
 TEST CONDITIONS = 5 DEGREES C/MIN

PARAMETER = TCLE AT CLASS POINT

UNIT OF MEASURE = IN/IN/DEG C

NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

AGE AT TEST (YEARS)

STAGE II DISSEC MRS. INNER THERMAL COEFF OF LINEAR EXPAN CP <0022587>

Figure 56

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

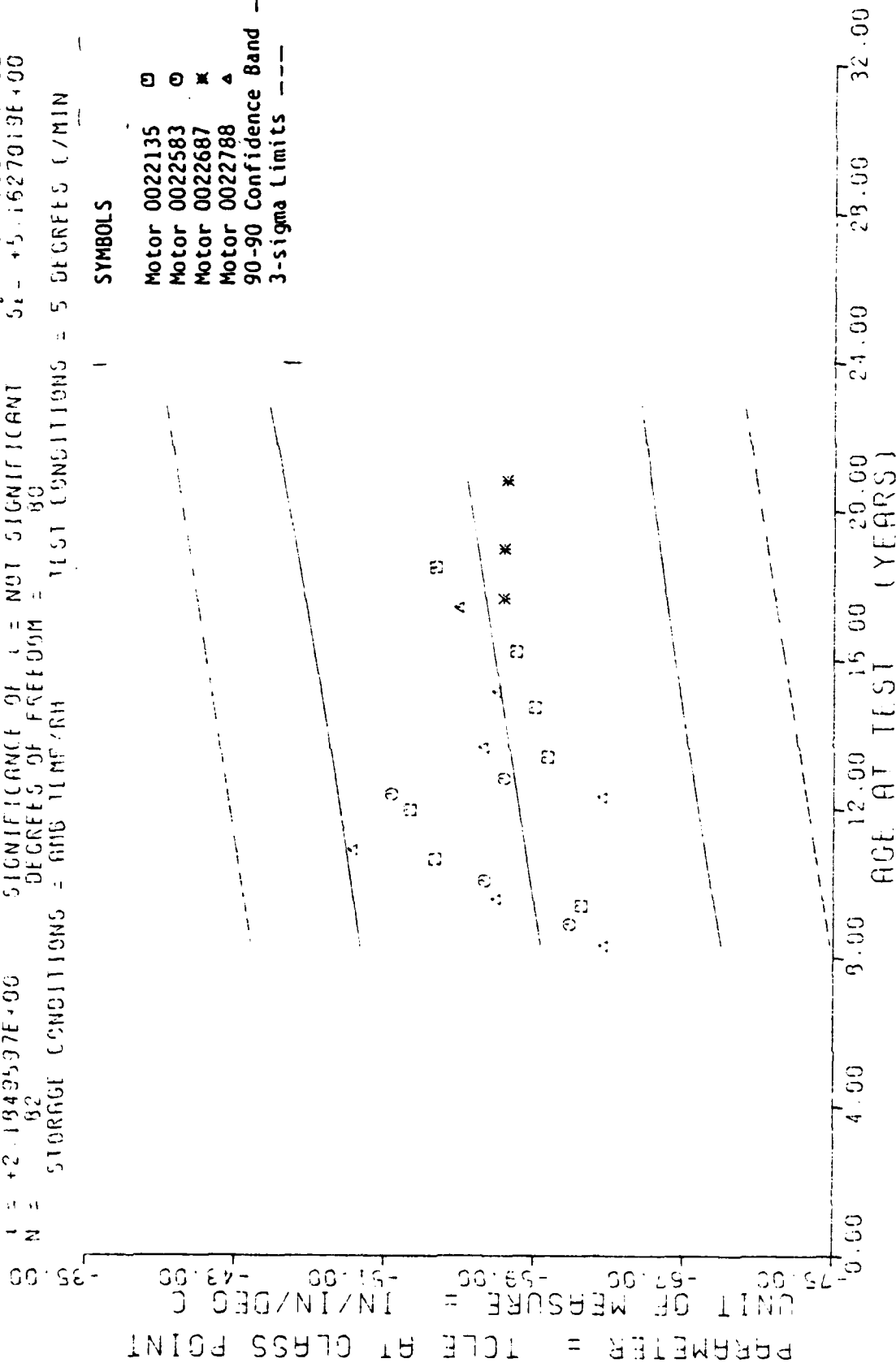
\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	3	-5.7333328E+01	+1.5275252E+00	-5.6000000E+01	-5.9000000E+01	-5.7304794E+01
228.0	3	-5.7333328E+01	+2.3094010E+00	-5.6000000E+01	-6.0000000E+01	-5.7382614E+01
250.0	6	-5.7500000E+01	+1.3784048E+00	-5.6000000E+01	-5.9000000E+01	-5.7489608E+01

STAGE II DISSEC MTRS. INNER. THERMAL COEFF OF LINEAR EXPAN GP <0022687>

Y = (1 - 5.1901084E+01) \* ( +2 6522125E-02 ) \* X )  
 F = +4 7740490E+00 SIGNIFICANCE OF F = SIGNIFICANT  
 R = +2 3730777E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT  
 T = +2 1849597E+00 SIGNIFICANCE OF T = NOT SIGNIFICANT  
 N = 82 DEGREES OF FREEDOM = 80  
 STORAGE CONDITIONS = 80 °C TEST CONDITIONS = 5 DEGREES C/MIN

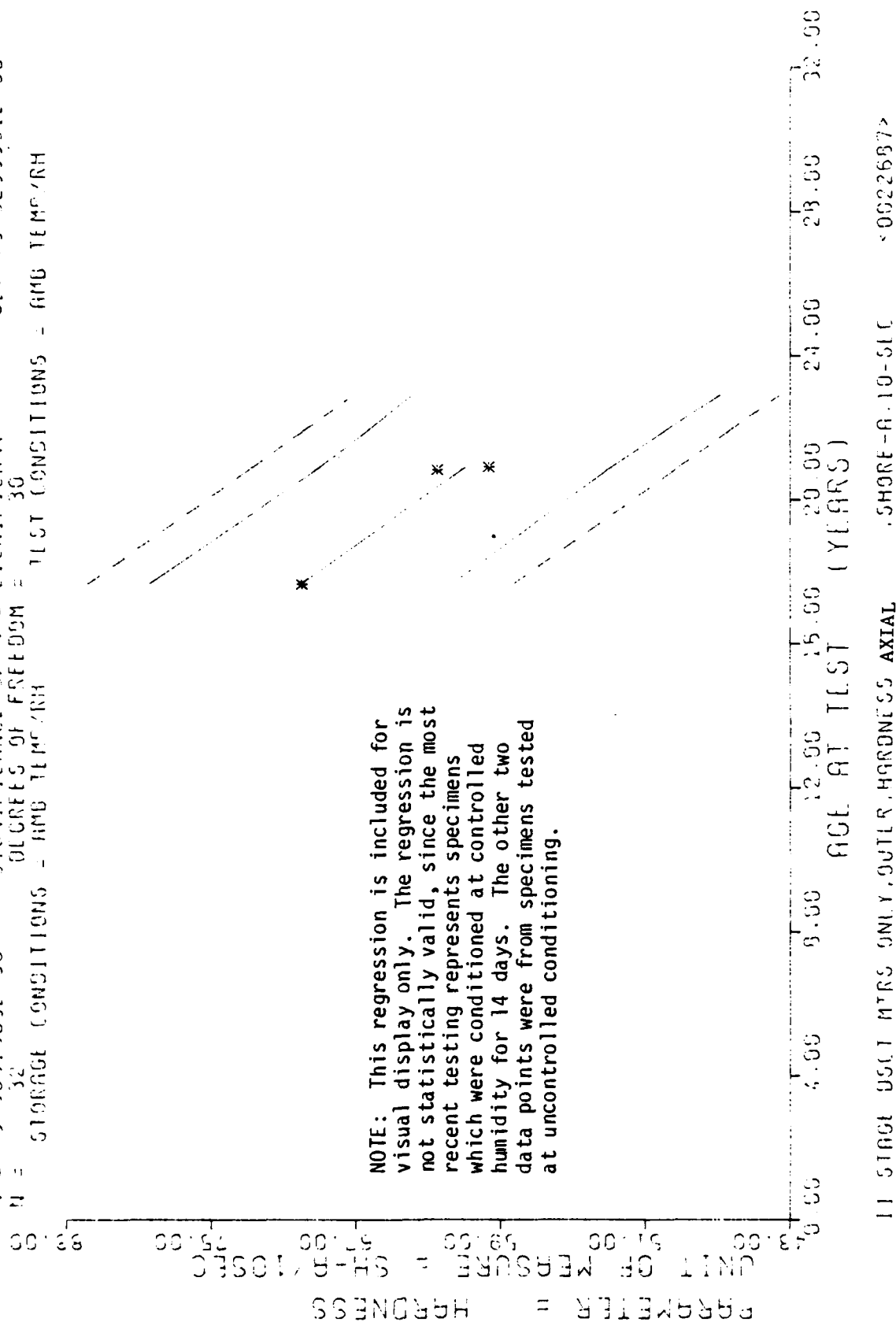
SYMBOLS  
 Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 ×  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



STAGE II DISSEC MRS. INNER. THERMAL COEFF OF LINEAR EXPAN CP <0022687>

Figure 56-B

F = +3.1451603E-01 SIGNIFICANCE OF F = (-2.333559E-01) \* X)  
 R = 7.11541013E-01 SIGNIFICANCE OF R = SIGNIFICANT  
 T = +5.5691869E+00 SIGNIFICANCE OF T = SIGNIFICANT  
 N = 32 DEGREES OF FREEDOM = 30  
 STORAGE CONDITIONS = RMB TEMP/RH TEST CONDITIONS = RMB TEMP/RH



NOTE: This regression is included for visual display only. The regression is not statistically valid, since the most recent testing represents specimens which were conditioned at controlled humidity for 14 days. The other two data points were from specimens tested at uncontrolled conditioning.

Figure 57

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	8	+7.0000000E+01	+6.7823299E+00	+7.8000000E+01	+6.2000000E+01	+6.8186309E+01
228.0	12	+6.3333328E+01	+2.7080128E+00	+6.8000000E+01	+6.0000000E+01	+6.5421813E+01
250.0	12	+6.2500000E+01	+1.3142574E+00	+6.5000000E+01	+6.0000000E+01	+6.1620635E+01

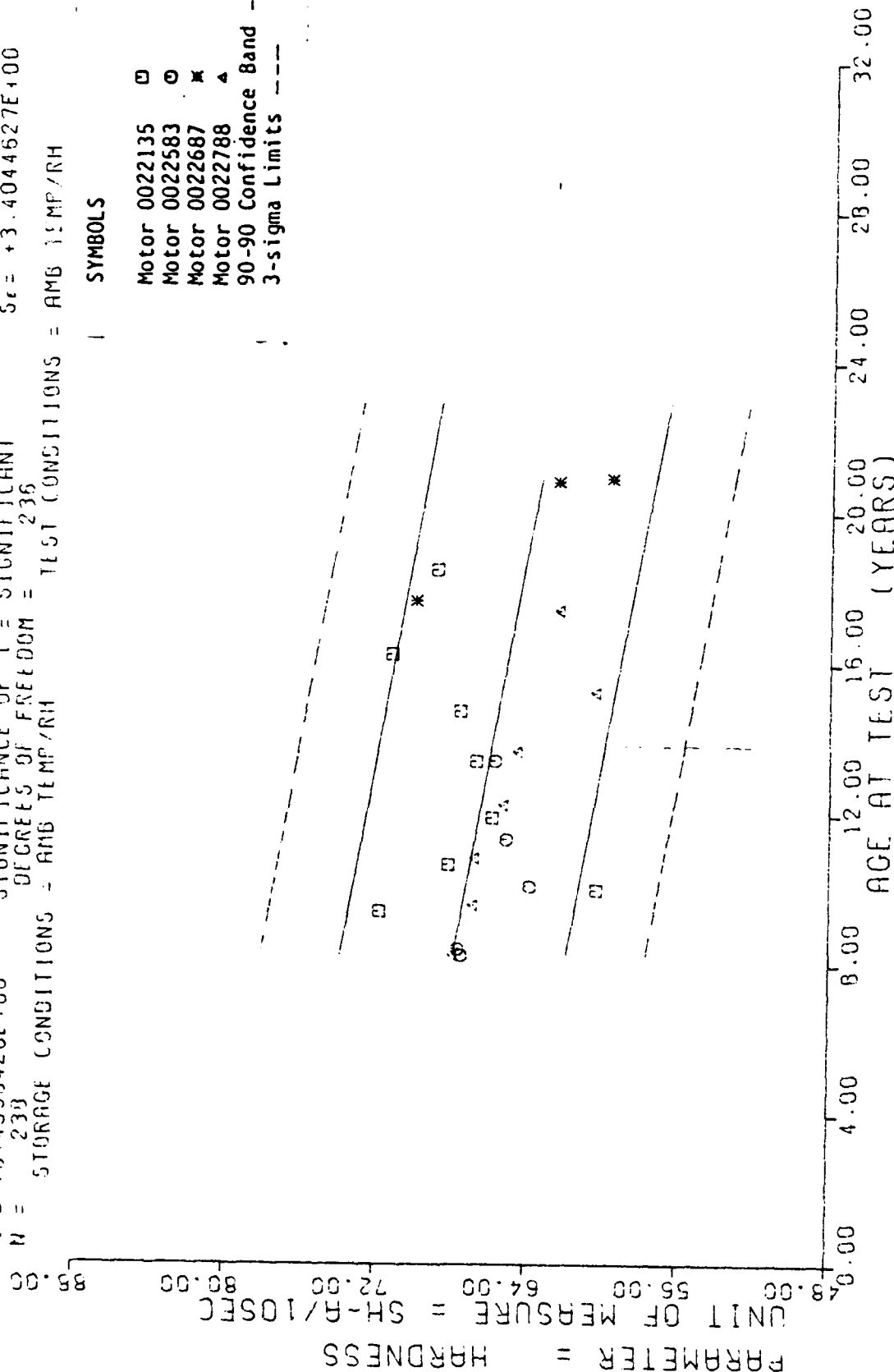
II STAGE DSCT MIRS ONLY. OUTER. HARDNESS,      SHORE-A. 10-SEC.      <0022687>

Figure 57-A

$F = +4.2247345E+01$   
 $R = +3.9966059E-01$   
 $L = +6.4998420E+00$   
 $N = 233$   
 STORAGE CONDITIONS = AMB TEMP/RH  
 DEGREES OF FREEDOM = 236  
 TEST CONDITIONS = AMB TEMP/RH  
 $Y = (1 + 7.0829536E+01) \cdot (-2.9643043E-02) \cdot X$   
 SIGNIFICANCE OF F = SIGNIFICANT  
 SIGNIFICANCE OF R = SIGNIFICANT  
 SIGNIFICANCE OF L = SIGNIFICANT  
 $G_1 = +3.6888449E+00$   
 $S_0 = +4.5605790E-03$   
 $S_1 = +3.4044627E+00$

# SYMBOLS

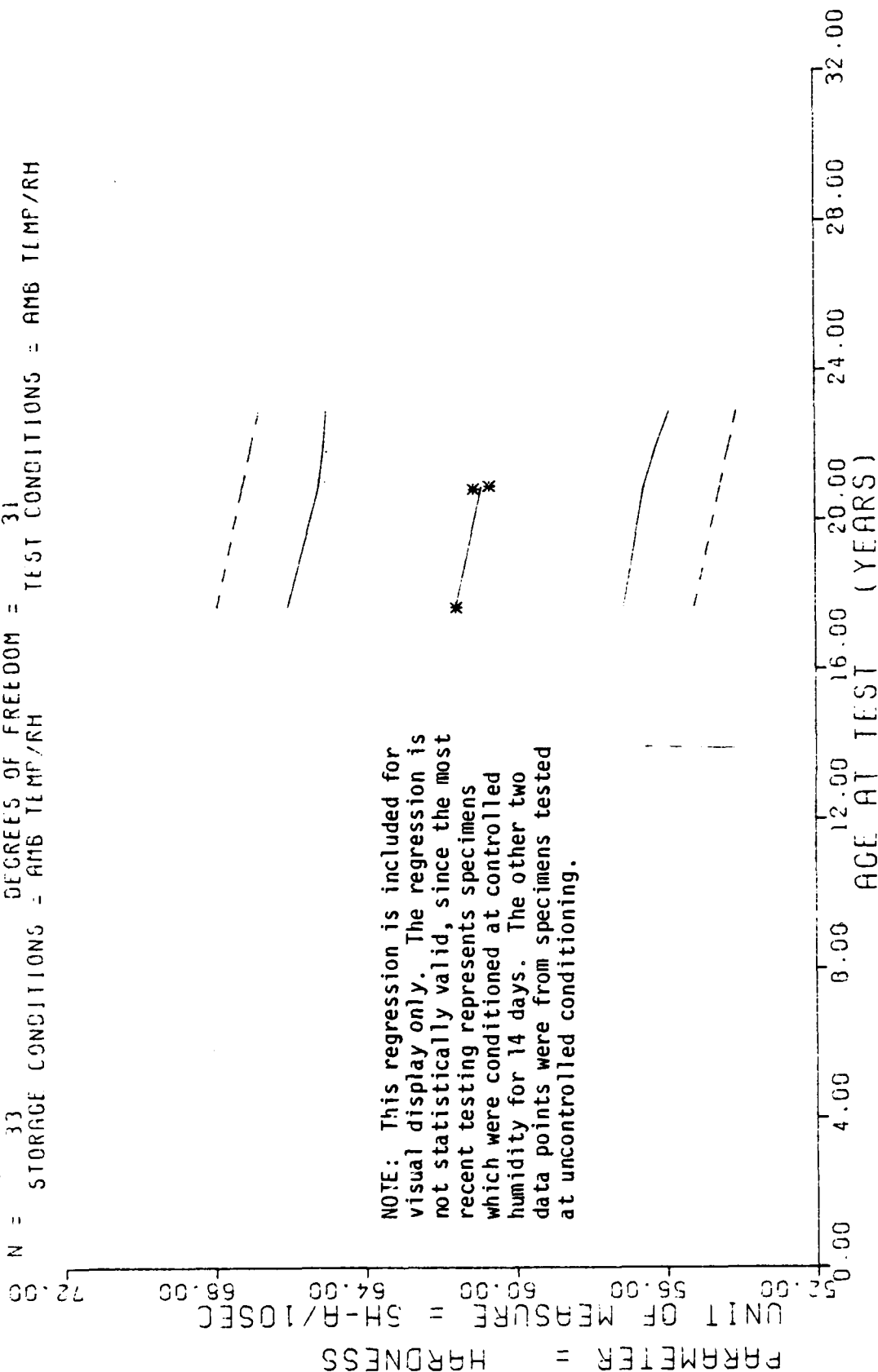
Motor 0022135 □  
 Motor 0022583 ○  
 Motor 0022687 \*  
 Motor 0022788 ▲  
 90-90 Confidence Band ---  
 3-sigma Limits ----



II STAGE D5CT MIRS ONLY, OUTER, HARDNESS, AXIAL SHORE-A, 10-SEC.

Figure 57-B

$Y = (1 + 6.5362212E+01) + (-1.7923362E-02) \cdot X$   
 $F = +6.9673198E-01$  SIGNIFICANCE OF F = NOT SIGNIFICANT  $G = +2.1056381E+00$   
 $R = +1.4826055E-01$  SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_0 = +2.1472697E-02$   
 $t = +8.3470472E-01$  SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_e = +2.1156873E+00$   
 $N = 33$  DEGREES OF FREEDOM = 31  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



II STAGE DSCT MTRS ONLY, INNER, HARDNESS, AXIAL SHORE-A, 10-SEC. <0022607>

Figure 58

\*\*\* LINEAR REGRESSION ANALYSIS \*\*\*

\*\*\* ANALYSIS OF TIME SERIES \*\*\*

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
212.0	9	+6.1555541E+01	+5.2704627E-01	+6.2000000E+01	+6.1000000E+01	+6.3366302E+01
228.0	12	+6.5166656E+01	+1.3371158E+00	+6.7000000E+01	+6.3000000E+01	+6.2820907E+01
250.0	12	+6.1083328E+01	+2.6097137E+00	+6.5000000E+01	+5.7000000E+01	+6.2071014E+01

II STAGE DSCT MTRS ONLY. INNER. HARDNESS. STORE-A. 10-SEC. <0022687>

Figure 58-A



Y = 11 +5 2786417E+01 ) + 1 +1 7431242E-03 ) \* X1  
 F = +5 3113332E-02 SIGNIFICANCE OF F = NOT SIGNIFICANT S<sub>1</sub> = +4.9919315E+00  
 R = +1 6774410E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S<sub>2</sub> = +5.7920625E-03  
 t = +2 5098530E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT S<sub>3</sub> = +5.0015311E+00  
 N = 214 DEGREES OF FREEDOM = 242  
 STORAGE CONDITIONS = AVG TEMP/RH TEST CONDITIONS = AVG TEMP/RH

**SYMBOLS**

- Motor 0022135 □
- Motor 0022583 ○
- Motor 0022687 \*
- Motor 0022788 ▲
- 90-90 Confidence Band —
- 3-sigma Limits ---

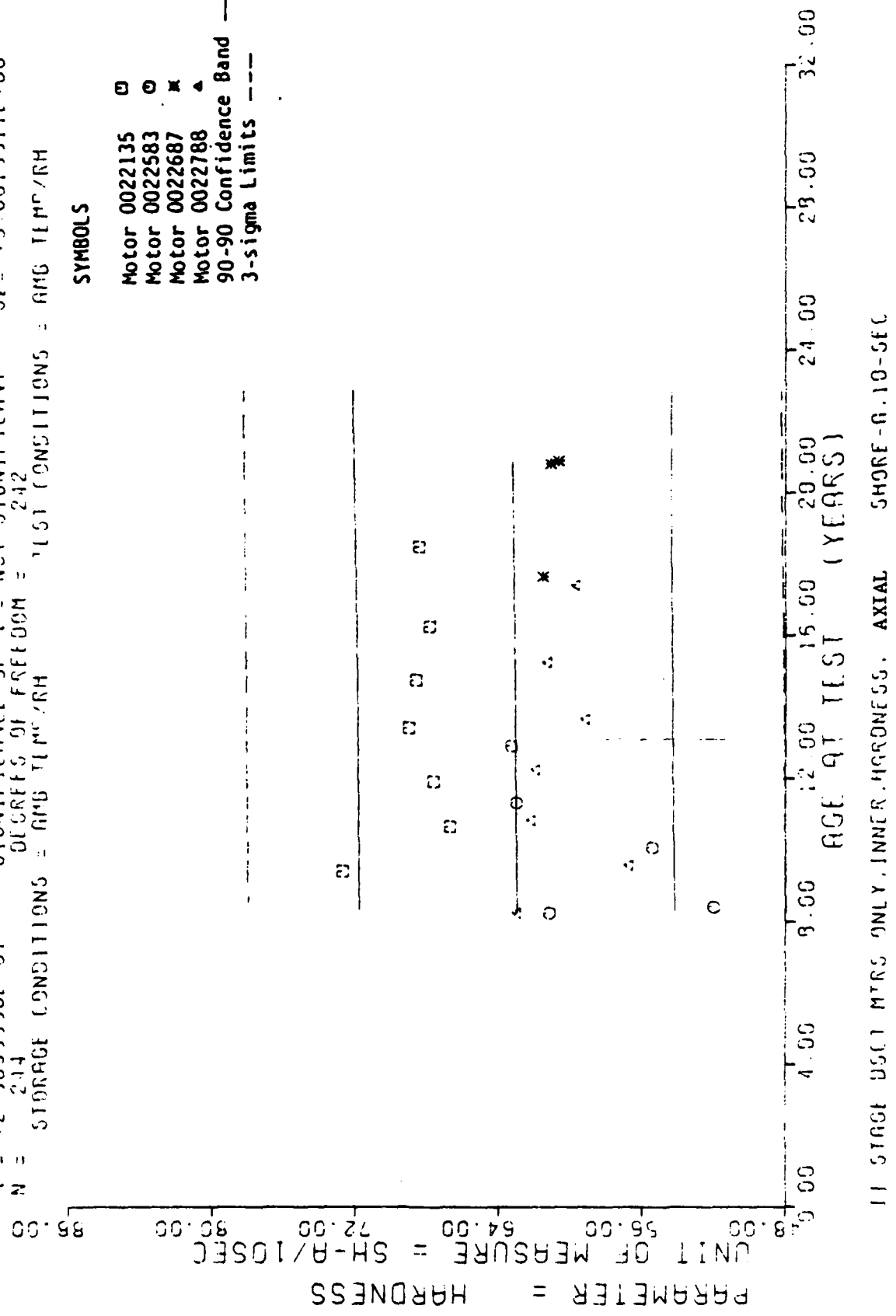


Figure 58-B

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  Data analysis in this report represents three test periods on dissected motor S/N 0022687. Two of the tests were performed prior to a change in the specimen conditioning requirements.  A Scheffe' test was used to determine where significant differences in test data occurred. Regressions of individual motor trends for many parameters are included in this report. There are statistically significant trend lines when		

compared to a slope of zero except for stress relaxation modulus. The three points used represent two populations since a change in humidity conditioning occurred in 1985 testing. Therefore, regressions are for visual reference only.

Multi-motor plots are included to show the relationship of motor S/N 0022687 to the other RSLP motors. The data for all Stage II dissected motors tested at 00-ALC are shown on these plots.

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